

# **Harlequin Duck Surveys in Western Montana: 1995**

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October 1996

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This document should be cited as follows:

Reichel, J.D. and D. L. Genter. 1996. Harlequin Duck surveys in western Montana: 1995. Montana Natural Heritage Program. Helena. vii + 107 pp.

## ABSTRACT

In 1995, Harlequin Duck pair surveys were conducted on 329 km of 22 streams finding a minimum of 37♂ and 23♀. A sex ratio of 1.51:1 (m:f, n =600) was observed during 1974-1975 and 1989-1995 Montana pair surveys. Brood surveys were conducted on 371 km of 23 streams yielding a minimum of 16♀, 40 juveniles, and 2 unknowns. Harlequins were reported on 19 additional streams. Breeding was confirmed for the first time on both the Middle Fork of Rock Creek, Deerlodge National Forest (Ben Canard pers. comm.) and the West Fork of the Yaak River, Kootenai National Forest in 1995. John Gangemi observed six female Harlequins in June 1995 on the Wigwam River, just north of the U.S./Canada border in Alberta, indicating for the first time that this stream has a breeding population. Though breeding was observed in 1990 on Big Creek (Koocanusa) and Trout Creek (Superior), no birds were seen during 1995 pair surveys. Likewise ducks were seen in 1988 on Quartz Creek but not during this year's survey. A minimum of 151 pairs of ducks nest in Montana representing an estimated 198 total pairs; there are currently 33 Harlequin Duck EO's and 32 streams, surveyed 0-5 times each, where Harlequin Ducks have been observed or reported but on which the breeding status is unknown.

Reproductive success, on streams surveyed both for pairs and broods in 1995, averaged 0.23 broods per female; average brood size at or near fledging (Class III) was 3.82. In Montana during 1974-1975 and 1989-1995, annual numbers of ducklings fledged per adult female averaged 1.39 and ranged from 0.13 - 3.15 (n=305 adult females). Brood size (IIb to fledging) averaged 3.59 and ranged from 2.00 - 5.86 (n=118 broods). The proportion of females successfully raising a brood in a single year varies widely between years. In Montana, stream surveys between 1974 and 1995 found 305 females raising 118 broods, for an average of 38.7% (range 7-55%).

We continued banding Harlequin Ducks in the Flathead and Clark Fork drainages. During 1995 in Montana, 10 adult males, 12 adult females, and 35 juveniles were captured and banded on 7 streams, bringing the total number banded since 1991 to 249 (39 males, 53 females, 157 juveniles). Adult males returned to their breeding streams from the previous year on 53% (n=51) of occasions, while females returned at a rate of 57% (n=81).

A minimum of 24 birds banded in Montana have been sighted in Oregon (2), Washington (1), and southern British Columbia (21), including Vancouver Island and Hornby Island. Sexes and ages at banding show the following numbers and percentages observed: adult females (6, 11%), adult males (2, 5%), juvenile females (9, 7%), and juvenile males (7, 5%).

In Montana and Idaho, several relatively long-distance movements have been documented both within and between years. Two males and several breeding females were observed using different nearby drainages during different years, indicating that movements within a drainage of up to 30 km may regularly, but rarely, occur.

Of 100 ducklings marked in 1992-93 in Montana, 14 females are known to have survived at least 2 years; of these, 5 were reported only from their natal stream, 1 only from the coast, and 8 from both the coast and the natal breeding stream. Seven males marked as juveniles were seen only on the coast; none have been reported from their natal stream.

## **ACKNOWLEDGMENTS**

We thank Bob Summerfield and Barry Paulson for their help throughout this years study. Much assistance in the field was provided by Chad Castren, Rob Fawcett, and Paul Hendricks. Additional field help, locations of possible trapping sites, and other logistical support was provided by J. Ashley, J. Davies, R. Galloway, C. E. Hidy, T. Hidy, W. Johnson, R. Kerr, P. Kitts, M. Lee, E. Pfalzer, and other Forest Service and Park Service personnel. M. Beer, D. Dover, C. Jones, and K. Jurist assisted with element occurrence and map preparation.

Information from surveys carried out by other agencies was provided by John Ashley (Glacier National Park), Jim Sparks (Gallatin National Forest), and Portia Jelinek (Lewis and Clark National Forest). Financial support for the project came from the Kootenai National Forest and Helena National Forest (U.S. Forest Service, Northern Region); the Montana Department of Fish, Wildlife and Parks; Glacier National Park (National Park Service); and the Montana Natural Heritage Program (Montana State Library, Natural Resource Information System and The Nature Conservancy cooperating).

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## **INTRODUCTION**

The Harlequin Duck (*Histrionicus histrionicus*) is a small sea duck, which travels inland to breed on fresh water streams. Harlequins breed in western North America from Alaska and the Yukon south through western Montana to California (Harlequin Duck Working Group 1993); in eastern North America, they breed from Baffin Island south to eastern Quebec and Labrador (Goudie 1993). In the Palaearctic, they breed in Iceland, Greenland and Siberia (A.O.U. 1983). Approximately 110-150 pairs of Harlequins currently breed in Montana (Reichel and Genter 1994), with most located in the following areas: 1) tributaries of the lower Clark Fork River; 2) tributaries of the North, Middle, and South Forks of the Flathead River; 3) streams coming off the east front of the Rocky Mountains; and 4) the Boulder River (Miller 1988, 1989; Kerr 1989; Carlson 1990; Fairman and Miller 1990; Diamond and Finnegan 1992, 1993; Reichel and Genter 1993, 1994, 1995).

During the breeding season, Harlequins are found along fast mountain streams (Bengtson 1966). In many areas, Harlequins use streams with dense timber or shrubs on the banks (Cassirer and Groves 1990), but they are also found in relatively open streams along the east slopes of the Rocky Mountains, Montana (Markum and Genter 1990, Diamond and Finnegan 1992), and in the Arctic tundra (Bengtson 1972). In Idaho, 90% of observations occurred near old growth or mature timber stands (Cassirer and Groves 1990). Mid-stream rocks, logs, islands, or stream-side gravel bars serve as safe loafing sites and appear to be important habitat components.

Most of the ducks arrive on their inland breeding areas in mid-April to early-May; unmated males typically arrive before pairs (Kuchel 1977). The males return to the coast shortly after the females begin incubation; most are gone by early July (Kuchel 1977). The females and young remain on the streams until August or early September. This chronology is influenced by elevation and by the timing of spring runoff; it may vary up to several weeks between years.

The U.S. Forest Service, Region 1, lists the Harlequin Duck as Sensitive (Reel *et al.* 1989). The species is listed as a Species of Special Concern by the Montana (Montana Natural Heritage Program 1994) and Idaho (Idaho Conservation Data Center 1994) Natural Heritage Programs. The eastern North American population is listed as Endangered in Canada (Goudie 1993).

The Montana Natural Heritage Program began surveying Harlequin Ducks in 1988. The survey data gave rise to questions involving site fidelity, productivity and mortality. We began individually marking Harlequins to a limited extent in 1991; through 1994, a total of 192 Harlequins were marked on 9 streams, representing the largest population of marked Harlequins from breeding streams. Birds marked in Montana have subsequently been captured and observed on the coasts of Oregon, Washington and British Columbia, with most reports coming from Vancouver Island. Long term goals include: 1) developing a baseline status report of current and historic Harlequin populations in Montana; 2) gathering information on site fidelity, reproduction and mortality to allow estimations of what constitutes a viable Harlequin population; 3) developing survey protocols for actual and potential Harlequin streams; 4) developing management guidelines for maintaining and restoring Harlequin populations and habitat; and 5) identifying coastal areas where Harlequins from the Northern Rockies occur. Goals for 1995 included: 1) surveying additional streams for presence and status of Harlequins; 2) gathering productivity data on some primary Harlequin streams; 3) marking as many individuals as possible on selected streams for long-term monitoring; and 4) summarizing distribution, population, movement, and survey data from Montana.

## **METHODS AND MATERIALS**

Harlequin Ducks were surveyed on parts of the Kootenai, Helena, Custer, Flathead, and Lolo National Forests and on the Stillwater State Forest during May-August 1995 (see Appendix C). Data sheets used are shown in Appendix A. We also marked birds in Glacier National Park; surveys there were conducted primarily by Park Service personnel (Ashley 1994a, 1994b). Most surveys were conducted by walking the stream channel (when possible) or stream bank. In most cases, the surveyor walked upstream, giving more time to observe the bird before it moved out of sight. Some larger streams were surveyed partially or completely by kayak. Dates, locations, distance surveyed, and general characteristics of the stream reaches surveyed were recorded; any location, numbers, ages, and sex of all Harlequins seen was recorded, as were habitat characteristics of the site. For streams in the Flathead and Clark Fork drainages, we attempted to capture and mark all birds seen when a licensed, qualified bird-bander was present on the survey (Reichel, Genter, or Hendricks). Captured birds were sexed, aged, weighed, measured (wing cord and tail), marked, and released. Except in Glacier National Park, all adult birds were marked with numbered USFWS aluminum leg bands and with colored nasal discs, which are individually recognizable by shape and color combination. Adults only in Glacier National Park, and all juveniles, were banded with a USFWS aluminum band and with a blue, plastic leg band with 2 white alpha-alpha or alpha-numeric characters.

## **SURVEYS AND BANDING**

### **MONTANA SURVEYS - 1995**

In 1995, Harlequin Duck pair surveys were conducted on 329 km of 22 streams, yielding a minimum of 37♂ and 23♀. Brood surveys were conducted on 371 km of 23 streams yielding a minimum of 16♀, 40 juveniles, and 2 unknowns.

***Kootenai National Forest.*** Pair surveys were conducted along 163 km of 11 streams during April-May 1995 (Appendix C). A minimum of 29 Harlequins (19 males, 10 females) were seen on 6 streams (Appendix C). These included Callahan Creek (1♂), Grave Creek (4 pairs), Marten Creek (3 pairs plus 3♂), Rock Creek (2♂), Swamp Creek (3 pairs plus 1♂), and the Vermilion River (3♂). No birds were seen on Quartz Creek, the Kootenai River at Kootenai Falls, or Big Creek (Koocanusa) though birds had bred there previously (see DISTRIBUTION - HISTORICAL CHANGES).

Brood surveys were conducted along 190 km of 13 streams during July 1995 (Appendix C). A minimum of 49 different Harlequin Ducks were observed on 6 streams (Appendix C). Callahan Creek had 1♀ present. Grave Creek had 2♀ present with broods of 1 and 4 chicks; 2 unknowns were also seen. Marten Creek had 4♀ present with 2 broods of 5 and 6 chicks. Rock Creek had 1♀ present with a brood of 5 chicks. Swamp Creek had 2♀ present, each with a brood of 5 chicks. The Vermilion River had a minimum of 3♀ present with 2 broods of 3 and 2 chicks; additionally, a female and her brood marked the previous day on Marten Creek were also seen (see MOVEMENT - ON THE BREEDING GROUNDS). Breeding was noted for the first time on the West Fork of the Yaak River where 1♀ had a brood of 2.

***Helena National Forest.*** Pair surveys were conducted along 56 km of 3 streams during May 1995 (Appendix C). No Harlequin Ducks were observed on any stream (Appendix C);

however, a pair was seen on the East Fork of the Blackfoot River on the Lolo NF, just east of the Helena NF.

**Other Northwest Montana Areas.** Pair surveys were conducted along 110 km of 8 streams during May 1995 (Appendix C). A minimum of 31 Harlequins (18 males, 13 females) were seen on 6 streams (Appendix C). These included the East Fork of the North Fork Blackfoot River (1 pair), North Fork Blackfoot River (4 pairs), Spotted Bear River (1♂), Sullivan Creek (1 pair plus 1♀ and 1♂), Swift Creek (2♂), and Trail Creek (6 pairs plus 2♂). No birds were seen on Trout Creek (Superior) where birds are known to have bred as recently as 1990 (see DISTRIBUTION - HISTORICAL CHANGES).

Brood surveys were conducted along 86 km of 5 streams during July - August 1995 (Appendix C). A minimum of 8 different Harlequin Ducks were observed on 2 streams (Appendix C). These included the Spotted Bear River (2♀, 1 brood of 5 young) and Sullivan Creek (1♀). Trail Creek with six pairs in the spring apparently did not produce any young (see CAUSES OF MORTALITY).

**Other Southwest Montana Areas.** Brood surveys were conducted along 95 km of 5 streams during early August 1995 (Appendix C). No Harlequin Ducks were observed on any stream (Appendix C).

**Surveys by Others.** Additional surveys were conducted by Glacier National Park (Ashley 1995), on the Boulder River by the Deerlodge National Forest (Jim Sparks pers. comm.), and the Lewis and Clark National Forest (Portia Jelinek, pers. comm.). Locations of birds seen on Forest Service surveys are reported in Appendix E. Reproductive parameters and movements discussed later in this report include data from Ashley (1995 and pers. comm.).

## SUMMARY OF MONTANA SURVEYS 1987-95

In Montana, 2963 km of streams have been surveyed since 1987 (Figure 1, Appendix G). Many of these stream reaches have been surveyed in multiple years and during both pair and brood season (Appendix G). Not all of these streams can be considered adequately surveyed. To be reasonably sure birds are not present on a stream where no previous sightings have occurred, at least two surveys should be conducted during the period 1-25 May. Due to lack of knowledge of proper survey timing, many surveys done prior to 1992 were done during June (after males have left and females are incubating) or after 10 August when many birds have left all but the streams in southwest Montana. The areas most likely to have ducks present, which need primary or additional surveys performed, are given in Appendix B.

## BANDING IN MONTANA: 1991-95

During 1995 in Montana, 10 adult males, 12 adult females, and 35 juveniles were captured and banded (Table 1). This brings the total number banded since 1991 in Montana to 249 (39 males, 53 females, 157 juveniles).

Table 1. Summary of harlequin ducks marked in 1995, not including birds marked in previous years and recaptured in 1995 (total ducks captured in all years including 1995 are in parentheses).

<u>Location</u>	<u>Male</u>	<u>Female</u>	<u>Juv.</u>	<u>Total</u>
McDonald Creek, Glacier NP	8 (15)	6 (28)	1 (51)	15 (94)
Trail Creek	(7)	(5)	(14)	(26)
Grave Creek		(1)	(4)	(5)
Spotted Bear River		1 (3)	5 (15)	6 (18)
Sullivan Creek, Flathead Co.		1 (1)	(6)	1 (7)
Marten Creek, Sanders Co.	2 (13)	(6)	11 (30)	13 (49)
Rock Creek, Sanders Co.	(3)	1 (4)	5 (11)	6 (18)
Swamp Creek, Sanders Co.		2 (2)	10 (11)	12 (13)
Vermilion River, Sanders Co.	(1)	1 (3)	3 (15)	4 (19)
<b>TOTAL</b>	<b>10 (39)</b>	<b>12 (53)</b>	<b>35 (157)</b>	<b>57 (249)</b>

## **DISTRIBUTION**

### NORTH AMERICA

**Breeding range.** The Harlequin Duck breeds in two disjunct regions in North America (Fig. 2). The Pacific population breeds from western Alaska, northern Yukon, northern British Columbia, and southern Alberta south to Oregon, Idaho, Wyoming, and east of the Continental Divide in Montana. The Atlantic population breeds from Baffin Island (at least formerly) through central and eastern Quebec, eastern Labrador, and northern Newfoundland. Occurs in summer in Mackenzie Valley and near Great Slave Lake, Northwest Territories (American Ornithologists Union 1983, Harlequin Duck Working Group 1993, 1994).

In the Rocky Mountains of the United States, Harlequins currently breed in western Montana (Reichel and Genter 1995), northern and southeastern Idaho (Cassirer and Groves 1994), and northwestern Wyoming (Wallen 1993, McEneaney 1994) (Fig. 3). While much of Montana and Idaho has been surveyed (Fig. 1), some areas with potential habitat have yet to be completed; surveying in Wyoming is less complete. As of 1995, surveys have been conducted on approximately 5,640 km of streams (Montana - 2,963 km; Idaho - 1,886 km; Wyoming 792 km) (Cassirer *et al.* 1996).

In the literature and in unpublished reports, Harlequins within a geographical area often noted as "breeding on XX number of streams." This has been used differently by various authors to mean: 1) every named stream; 2) larger named streams; or 3) the major stream in an occupied drainage. Not all streams used by harlequin ducks during the breeding season are used for nesting or brood-rearing. Some streams where adult harlequins are observed may be used only during migration to and from breeding areas. In order to classify harlequin duck observations in a consistent manner, definitions have been proposed by Cassirer *et al.* (1996), the first two of which would be considered "Element Occurrences" (EOs) by Natural Heritage Programs/Conservation Data Centers throughout North America.

### **Harlequin duck breeding occurrence:**

Drainages or portions of drainages used by harlequin ducks where breeding is known, i.e., a brood or nest has been observed within the last 15 years. Comprised of contiguous stream reaches (and portions of lakes, reservoirs, or bays) used during the courtship, nesting, and brood-rearing periods not separated by more than 10 km of unsuitable habitat or by 20 km of unoccupied, suitable habitat.

### **Probable harlequin duck breeding occurrence:**

Drainages or portions of drainages used by harlequin ducks where breeding is highly suspected, i.e., there have been at least 3 independent pair or female observations within the last 15 years. Comprised of contiguous stream reaches (and portions of lakes, reservoirs, or bays) used during the courtship, nesting, and brood-rearing periods not separated by more than 10 km of unsuitable habitat or by 20 km of unoccupied, suitable habitat.

### **Breeding status unknown:**

Drainages or portions of drainages with at least 1 harlequin duck observation but fewer than 3 independent pair or female observations during the breeding season within the last 15 years.

### **Breeding unlikely:**

Observations of males during migration periods. The male migration periods are before 15 April and after 5 June in the Northern Columbia Basin and Rocky Mountain Front areas and before 1 May and after 20 June in the Intermountain region.

Observations of pairs outside the prenesting season. The prenesting season is from 15 April - 5 June in the Northern Columbia Basin and Rocky Mountain Front areas and from 1 May - 20 June in the Intermountain area.

Incidental observations in unsuitable habitat such as ponds or large, low gradient (<1%) rivers not adjacent to known breeding sites, or observations on streams which have been identified as lacking breeding activity (e.g. migratory staging areas or stopovers).

Applying these criteria to the U.S. Rocky Mountains, there are currently 48 known breeding occurrences (89 streams), 10 probable breeding occurrences (29 streams) and 81 streams where breeding status is unknown (Cassirer *et al.* 1996).

The breeding status on many streams with Harlequin Duck sightings has not been established in the Rocky Mountains of Montana, Idaho, or Wyoming. In Montana, there are currently 33 Harlequin Duck EO<sub>s</sub>, and 32 streams where Harlequin Ducks have been observed or reported but on which the breeding status is unknown; these streams have been surveyed 0-5 times each (Figure 3, Appendix B). In Idaho, there are currently 16 Harlequin Duck EO<sub>s</sub>, and 24 streams where Harlequin Ducks have been observed or reported but on which the breeding status is unknown; these streams have been surveyed 0-5 times each (Cassirer *et al.* 1996.). In Wyoming, there are currently 8 Harlequin Duck EO<sub>s</sub>, and 17 streams where Harlequin Ducks

have been observed or reported but on which the breeding status is unknown; these streams have been surveyed 0-5 times each (Cassirer *et al.* 1996.).

Using habitat characteristics, accessibility, amount of human use, and nearby Harlequin Duck occurrences, streams were identified that had the highest potential for Harlequin Duck occurrence but for which no ducks had been observed; these included 31 in Montana (Appendix B), 16 in Idaho, and 41 in Wyoming (Cassirer *et al.* 1996).

**Winter range.** Winters in the Aleutian and Pribilof islands south on the west coast of North America to Oregon, rarely to central California; southern Labrador, Newfoundland, Nova Scotia, south to Maryland (but mostly north of Cape Cod); accidental in Hawaii and the Great Lakes; much more abundant in the Aleutians than farther south in southwestern Canada and the U.S. Pacific Northwest (Fig. 2). Most Harlequins marked in Montana have been reported from wintering grounds off of British Columbia, with fewer reports from Washington and Oregon (see MOVEMENT: *Timing and routes of migration*).

## OUTSIDE THE AMERICAS

In the Palearctic, the Harlequin Duck breeds in Iceland and Greenland in the Atlantic Ocean, and from the Lena River in Siberia east to Kamchatka and south to northern Mongolia, the Kurile Islands, and northern Japan in the Pacific Ocean; winters in Eurasia south from the pack ice to the east coast of Korea and central Japan in the Pacific and on the Atlantic in the ice-free zones around Iceland and Greenland (Philips 1925, Salomonsen 1950, Dement'ev and Galdkov 1967, Portenko 1981, American Ornithologists Union 1983, Boertmann 1994) (Fig. 2).

## HISTORICAL CHANGES

During the past 100 years, the range of the Harlequin Duck has undergone both large and small scale contractions. Historically, Harlequins bred in Colorado, probably as a small isolated population, until at least 1883 (Parkes and Nelson 1976); currently, they do not breed in the state. In Oregon, Harlequins historically bred in the Wallowa and probably Blue Mountains of the northeastern part of the state (Gabrielson and Jewett 1940, Latta 1993). They are thought to have historically bred much more widely in the North Atlantic region (Merriam 1883, Peters and Burleigh 1951, Goudie 1989, 1993).

On a smaller scale, heavy white-water rafting is believed to have been the primary factor in the displacement and resulting extirpation of Harlequins on the Methow River in Washington (Brady pers. comm. in Clarkson 1994). In Yoho National Park, Alberta, Harlequins regularly bred in the vicinity of Lake Ohara until 1985; they have not since been seen (Hunt and Clarkson 1993). This area now has heavy recreational use, building facilities, and a hiking trail encircling the lake.

Within the Rocky Mountains of Montana, Idaho, and Wyoming, few historic records exist for either known current or extirpated Harlequin occurrences (Table 2). The scant existing evidence indicates that Harlequin Ducks were once more widespread. In addition to the historic Montana, Idaho, and Wyoming streams listed in Table 2, Harlequins have not been observed during recent surveys of Big Creek, Quartz Creek, or Trout Creek, Montana, indicating possible extirpation (Table 3).

**Table 2. U.S. Rocky Mountain streams previously used by Harlequin Ducks where no use has been documented since 1988 (Cassirer et al. 1996, this report)**

State	Historical consistent use documented	Historical occasional breeding documented	Historical occasional pair use documented
<b>Idaho</b>	Kelly Creek and N. Fork Clearwater River below Kelly Creek (3) <sup>1</sup>	Smith Creek (Kootenai River) (3) <sup>1</sup>	Orogrande Creek (N. Fork Clearwater River) (4) <sup>1</sup>
<b>Montana</b>	Kootenai Falls area of Kootenai River (13) <sup>2</sup>	Otatso Creek	Bighorn River Canyon Jocko River Sweet Water Creek
<b>Wyoming</b>			Shell Creek Canyon

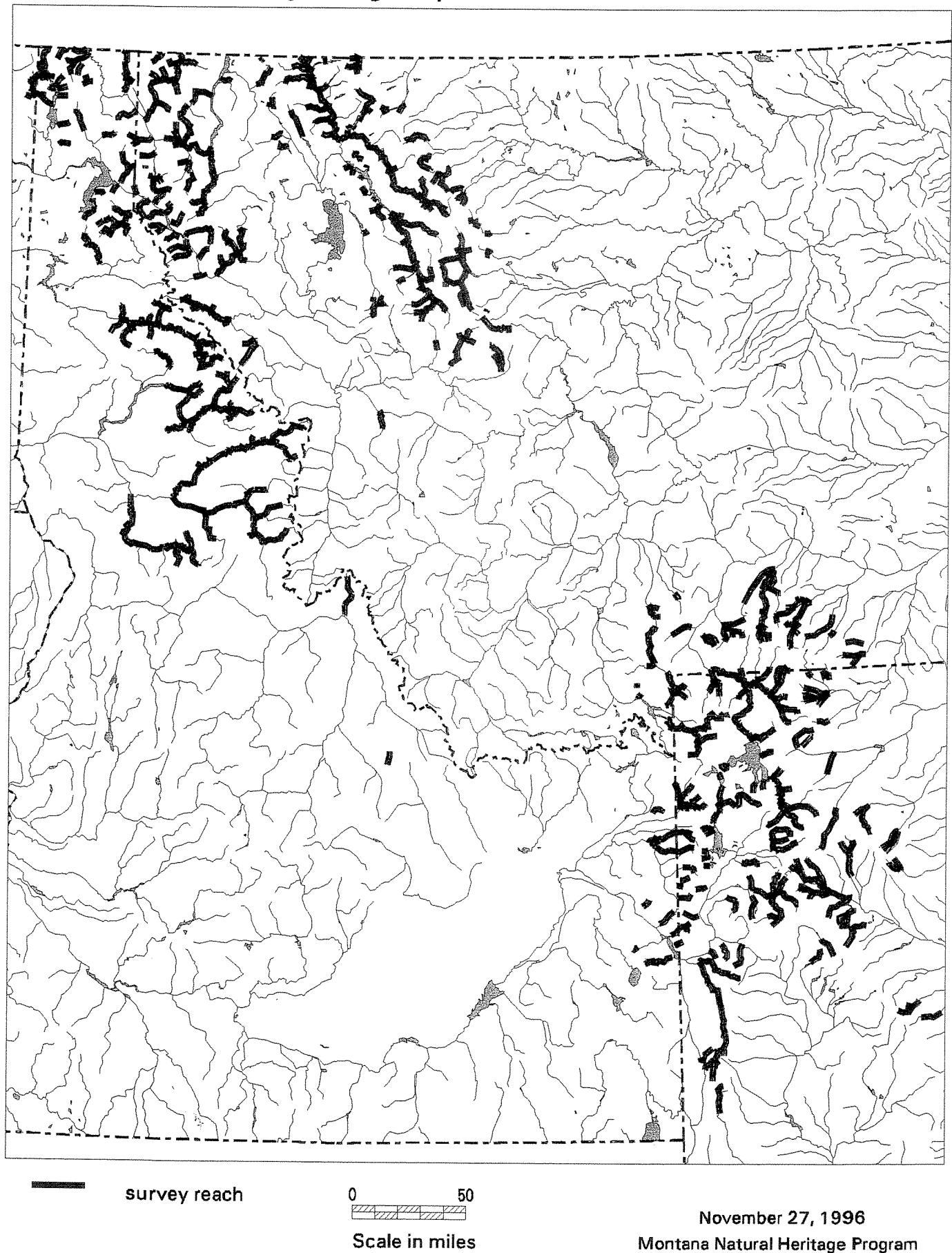
<sup>1</sup>Number in parentheses represents the number of surveys between 1989 - 1994

<sup>2</sup>Number in parentheses represents the number of surveys between 1989 - 1995

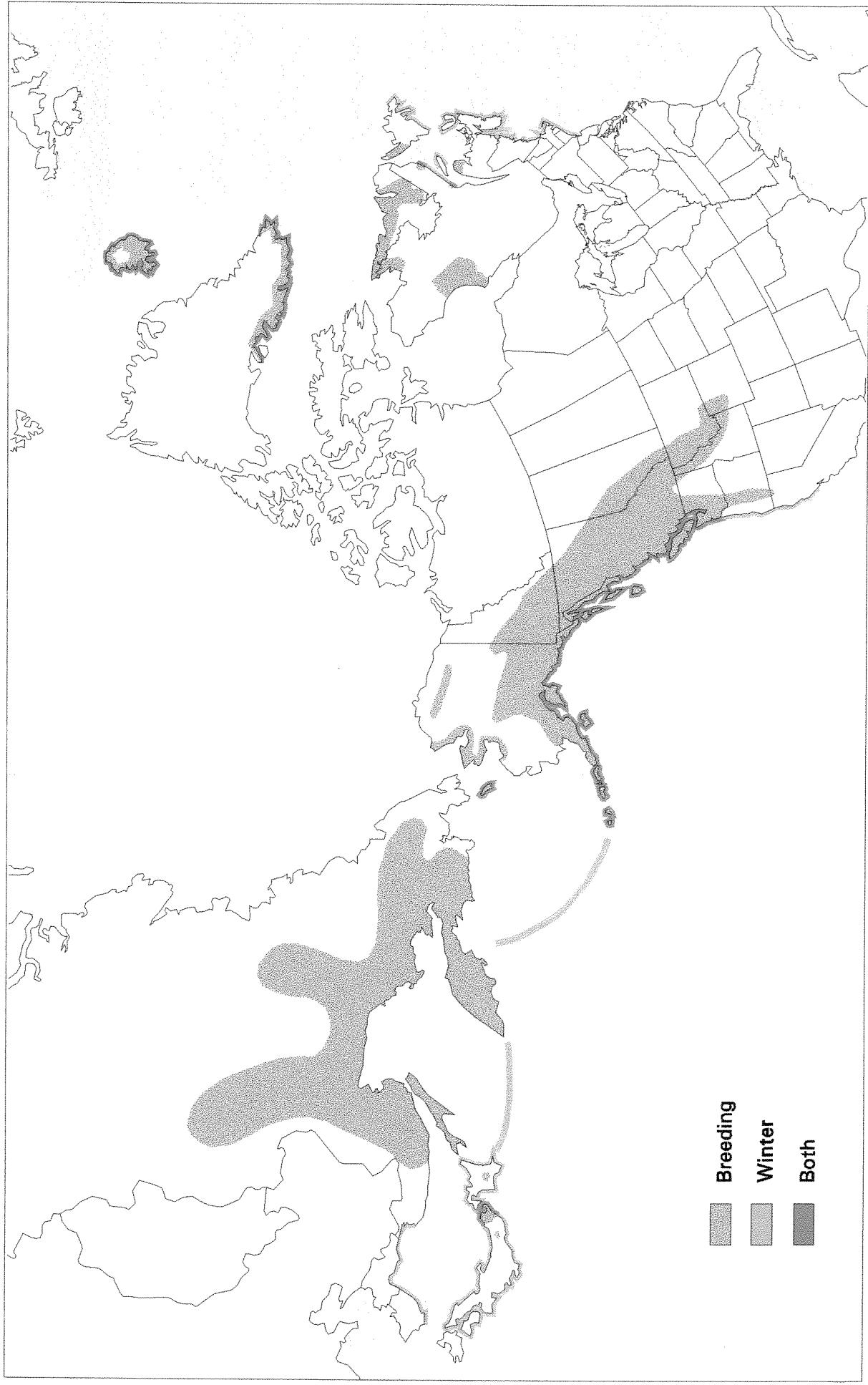
**Table 3. Streams in Montana where Harlequins have not been observed during recent surveys.**

Stream	Last year seen	Years surveyed since last seen
Big Creek (Kootenai R.)	1990	1991, 93, 94, 95
Quartz Creek (Kootenai R.)	1988	1989, 90, 95
Trout Creek (Superior)	1990	1991, 92, 93, 95

**Figure 1. Streams surveyed for Harlequin Ducks in Montana, Idaho, and Wyoming during the period 1985 - 1995.**

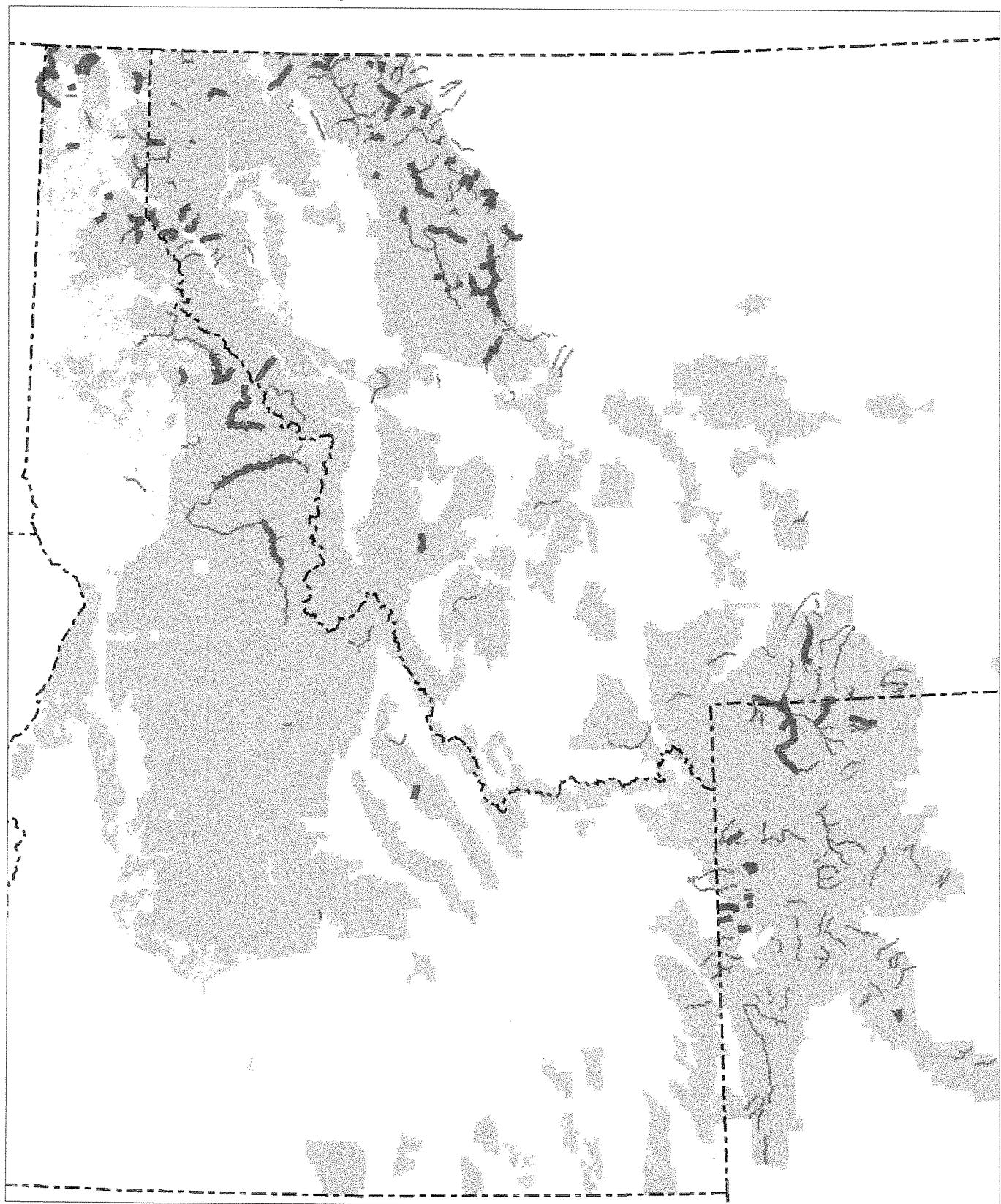


**Figure 2. World distribution of Harlequin Duck.**



Montana Natural Heritage Program, November 27, 1996

**Figure 3. Breeding and probable breeding streams in Montana, Idaho and Wyoming**



===== breeding  
===== probable breeding  
===== breeding status unknown  
===== national forests/national parks

0 50  
Scale in miles

November 27, 1996  
Montana Natural Heritage Program

## **MOVEMENT**

### **ON THE BREEDING GROUNDS**

In Montana and Idaho, several relatively long-distance movements have been documented both within and between years (Table 4). Two males and several breeding females were observed using different nearby drainages during different years. These observations indicate that movements within a drainage, both within and between years, of up to 30 km may regularly, but rarely, occur. Movements occurred even over large reservoirs (Noxon Reservoir) and lakes (Lake McDonald). The 1995 movement by a female and her entire fledged brood to the Vermilion River (Table 4) was likely the result of disturbance due to marking; however, the movement took place at least 4 hours following the release of the birds. The female in Glacier Park (Table 4) has been seen at several locations on different streams over the 4 years since her banding (Ashley 1995); the locations in Table 4 are maximum total known distances moved during the 4 year period.

There is little published literature regarding movement within the breeding grounds. Kuchel (1977) found that pairs used lower McDonald Creek prior to establishing home ranges higher up along the stream. Once established, pairs rarely moved more than 1-2 km, although movements of up to 8 km were recorded. Kuchel (1977) found unpaired males moved considerably more, with movements of up to 10 km found. In a reanalysis of Kuchel's (1977) data, Cassirer and Groves (1992) found that linear home ranges averaged 7.7 km ( $SD = 2.34$ ) on McDonald Creek, similar to the 7 km reaches used in Idaho.

On the Bow River in Banff National Park, 5 pairs of birds were marked at what is probably a staging area or local migratory corridor (Smith 1996). Two pairs remained in a 2 km section of river where they were banded, and another remained in a 2 km stretch about 12 km downstream; one pair remained within about 6 km until the female moved about 8 km up a drainage, perhaps to breed; the final pair moved about 15 km downstream within 22 days (Smith 1996).

For 35 Harlequins marked in Iceland, Bengtson (1972) found no movement overland between breeding streams and movement of only a few km within drainages. Not only did the birds return to the same drainage, but in 22 out of 33 cases, the birds were observed within 100 m of their locations during the previous year (Bengtson 1972).

**Table 4. Significant movements of Harlequins within and between years on the breeding grounds (Cassirer and Groves 1994, Reichel and Genter 1994; Ashley 1995, Cassirer pers. comm.; this report).**

Sex and age	1st Date	Location	2nd Date	Location	Km moved
Adult Male	1990	Gold Creek, ID	1991	Granite Creek, ID	14
Adult Male 755-76075	5/26/93	Marten Creek, Devils Gap	4/27/95	Vermilion River, 0.1 mi above Miners Gulch	31
Adult Female	5/85	Hughes Fork, ID	7/17/91	Upper Priest River, ID	??
Adult Female 755-76007	8/4/92	Marten Creek, mouth of (w/ brood)	7/30/93	Swamp Creek, T25N R31W Section 9 (w/ brood)	16
Adult Female 755-76025	8/10/92	McDonald Creek above McDonald Lake (w/ brood)	6/29/95	Middle Fork Flathead River (w/ brood)	18
Adult Female 755-76013	7/28/95	Marten Creek, near mouth of (with 6 young 925-09336, 37, 38, 39, 40, 41)	7/29/95	Vermilion River (with 6 young 925-09336, 37, 38, 39, 40, 41)	26

## MIGRATION

**Nature of migration in the species.** All inland populations of the species migrate to coastal waters. A marked female seen on Granite Creek, Idaho on 17 July 1991 was relocated 13 days later off of Battleship Island in the San Juan Islands, Washington (Cassirer and Groves 1992). In Iceland, birds are thought to swim up the rivers from the coastal wintering grounds to the freshwater breeding sites (Gudmundsson 1961 *in Bengtson 1966*).

Several lines of reasoning indicate that pairs migrate to the breeding grounds together: 1) two pairs marked on the breeding grounds in McDonald Creek, Montana, have been seen, apparently paired, in the spring on Hornby Island, B.C., prior to migration (Ashley pers. comm.); 2) one bird of a pair is not seen prior to the arrival of the other - they are seen for the first time together; and 3) there are no records of lone males observed later paired during the same year.

Sibling juveniles may migrate together to the coast, as indicated by the presence of 3 siblings at Hornby Island, B.C., which were marked together 7 months earlier on Swamp Creek, Montana. Whether females and their broods migrate together in some instances is unknown. However, it is known that females occasionally leave prior to their young fledging. In Montana, out of 102 brood observations during 1988-95, 12 broods (12%) were found without the hen prior to migration (this report, Ashley pers. comm.). Of the 12 abandoned broods, 1 was first seen alone when Class I, 2 were Class II, 2 were Class III, and 7 broods were first observed without the adult female following fledging. In one additional case, a brood of 7 was marked with the female on 11 Aug 1992; on 2 September the female was seen with 5 of her fledged juveniles, while one of the brood was observed 2.5 km away.

**Timing and routes of migration.** Harlequins, typically unpaired males, begin to arrive in Montana in mid-April (Kuchel 1977, Ashley 1994); the earliest record for Glacier National Park is 4 April 1970, on the Middle Fork Flathead River (Kuchel 1977:32). Pairs in Montana begin to

arrive in late April, and most are present by early May (Kuchel 1977, Ashley 1994, Reichel and Genter unpubl. data). Two-year-old females may arrive later than older females (Ashley 1994, Kuchel 1977:32); this age group may be the unpaired females that Wallen (1987) reported as arriving about 4 weeks later than pairs and then not breeding. Males begin leaving Montana by late-May, and are typically gone by late June (Kuchel 1977, Reichel and Genter 1993, Ashley 1994). Females begin leaving by early July if breeding is unsuccessful, and otherwise by mid-late July. Juvenile birds leave last, beginning in late July, and both adult females and juveniles are gone by the beginning of September (Ashley 1994, Reichel and Genter unpubl. data).

In Washington, birds arrive on breeding streams in late March or early April (Schirato 1993). In Oregon, birds arrive on the breeding streams in late April, although some have been reported as early as late February (Latta 1993).

Of 249 Harlequins banded in Montana from 1991-1995, a minimum of 24 have been reported from Oregon (2), Washington (1), and southern British Columbia (21), including Vancouver Island and Hornby Island. Sexes and ages at banding show the following numbers and percentages observed: adult females (6, 11%), adult males (2, 5%), juvenile females (9, 7%), and juvenile males (7, 5%). Two females radio-marked in Idaho were located in the San Juan and Gulf Islands of Washington and British Columbia, while one banded bird was reported from northwestern Washington (Cassirer and Groves 1994). The only known wintering bird marked in Wyoming was observed off of San Juan Island in Washington in August 1989; he returned to Grand Teton National Park as an unpaired male in 1990 (Cassirer and Groves 1991, Wallen 1993).

Some evidence of staging areas on the breeding grounds exists. Some marked harlequins observed in early spring on McDonald Creek, Montana, disappear almost immediately (Kuchel 1977, Ashley pers. comm.); these may be going to different drainages in the vicinity. At Kootenai Falls, Montana, in the early 1980s, only 1 pair bred in the immediate vicinity, while up to 6 other adults appeared to loaf there prior to and following the breeding season (Thompson 1985, Genter unpubl. data).

There are few records of birds stopping between their breeding areas and wintering areas. A single marked bird has been observed en route from wintering to breeding grounds. She was originally marked in Wyoming and observed on the way back to the breeding stream on Crooked Creek, South Fork Clearwater drainage, in central Idaho and seen about a week later in Grand Teton National Park (Cassirer and Groves 1991, Wallen 1993).

**Migratory behavior.** It is believed that nearly all one-year-old birds, and some (perhaps most) two-year-old birds remain in coastal water, not moving to breeding streams until they are 2-4 years of age. The proportion of each age class which stays on the coast has yet to be determined, but indications are that perhaps  $\frac{1}{2}$  of 2-year-old females and  $\frac{1}{4}$  of 3-year-old females do not return to the breeding grounds (see DEMOGRAPHY AND POPULATIONS:

**MEASURES OF BREEDING ACTIVITY - *Age at first breeding; intervals between breeding*.** Wallen (1987) reported that a 1-year-old female (n=11) returned to Upper Moose Creek, her natal stream in Grand Teton National Park in 1986. This is the only report of a 1-year-old female on the breeding grounds. No one- or two-year-old males, out of 176 male observations, have been seen in Montana during 1992-95 surveys (this report, Ashley pers. comm.).

## **DEMOGRAPHY AND POPULATIONS**

### **MEASURES OF BREEDING ACTIVITY**

***Age at first breeding; intervals between breeding.*** Only a single known-aged male has been seen with a mate; it was marked as a juvenile in 1992 on Mineral Creek, Montana, and observed by J. Ashley paired with a female (white NH) at Hornby Island, BC, in March 1996. Adult male breeding plumage is attained at three years of age (Phillips 1925). No one- or two-year-old males, out of 176 independent male observations, have been observed in Montana during 1992-95 surveys (this report, Ashley pers. comm.). Very few, if any, 1 or 2-year-old males have been reported on the breeding grounds in North America. Yearling males make up 1-2% of the population on the breeding grounds in Iceland (Bengtson 1972, Gardarsson 1979).

The youngest female known to have bred is a 2-year-old which raised a brood of 3 in 1994 on Trail Creek, Montana; nine additional non-breeding (or not successfully breeding) 2-year-olds have been observed on natal streams and 16 marked 2-year-olds are known to have been alive. Additionally, only a single 3-year-old has bred successfully (on Marten Creek in 1995); 7 additional non-breeding 3-year-olds have been observed on natal streams, and 11 marked 3-year-olds are known to have been alive. Ages of females when first seen on the breeding grounds have included 2-year-olds (10) and 3-year-olds (4); females seen on the wintering grounds, that had not been seen on the breeding grounds, included 1-year-olds (2) and 3-year-olds (3). Since we began marking juveniles in 1992, the oldest known-age birds in 1995 were 3-year-olds. In Iceland, Bengtson (1966) believed that 2-year-old females Harlequins did not regularly go to the breeding grounds; this was opinion, and not based on known-age birds.

Some females on breeding streams apparently, however, do not lay eggs (Bengtson and Ulfstrand 1971, Dzinbal 1982, Wallen 1987, Cassirer and Groves 1991). Bengtson and Ulfstrand (1971) classified 15-30% ( $n=48$ ) of adult (by bursae inspection) females as non-breeders, and found that 87% of all clutches were successful; therefore, approximately 90% of non-breeding females did not even attempt to breed in Iceland. Additionally, examination of ovaries of 6 non-breeding females showed that none had lain eggs (Bengtson and Ulfstrand 1971). Many of these non-breeding "adults" may have been young (2-3 year-old) birds, since cloacal examination gives adult status to 2-year-olds. Dzinbal (1982) estimated that 53-95% of females not producing broods did not attempt to breed; those results may have been due to use of patagial markers negatively affecting breeding behavior (Bustnes and Erikstad 1990). Wallen (1987) reported that some females left the breeding stream at the same time as their mates; unpaired females arrived about 4 weeks later than pairs, did not breed, and left after 3-5 weeks.

***Clutch size.*** Twelve clutches from the Pacific Northwest averaged 6.25 eggs (range 3-7) and are listed below. In Montana, a clutch of 5 was reported (Diamond and Finnegan 1993), four clutches of 6, 6, 7, and 7 were reported in British Columbia (Campbell *et al.* 1990), and 2 clutches of 7 were reported in Washington (Jewett *et al.* 1953). Cassirer *et al.* (1993) reported 3 nests with 3, 5, and 7 eggs in Idaho. Thompson *et al.* (1993) reported 2 nests, each with 7 eggs, in Oregon, while Gabrielson and Jewett (1940) reported a clutch of 6 eggs on 30 May 1931 on the Salmon River near Zigzag. In Iceland, 77 complete clutches averaged 5.7 eggs with a range of 3-9 (Bengtson 1972). There was a seasonal decline in clutch size (Bengtson 1972). The mean number of eggs to hatch from successful nests was 5.3 (Bengtson 1972). A single known Greenland clutch was 8 (Salomonsen 1950).

***Annual and lifetime reproductive success.*** Reproductive success was poor in Montana in 1995, with one of the lowest numbers of broods and young per female recorded since 1989 (Table 5, 6). In Montana during 1974-1975 and 1989-1995, annual numbers of ducklings fledged per adult female averaged 1.39 and ranged from 0.13 - 3.15 (n=305 adult females) (Table 6). Brood size (IIB to fledging) averaged 3.59 and ranged from 2.00 - 5.86 (n=118 broods) (Table 6).

Broods ranged from 1-6 in Oregon and averaged 2.7 (n=26) (Thompson *et al.* 1993, 1994). These sightings, however, were spread throughout the breeding season and therefore should not be considered the same as numbers fledged.

In Idaho, number of ducklings fledged per adult female ranged from 0.7 - 1.3 and averaged 1.2 (n=14); number of females producing broods was 29% in 1990 (Cassirer and Groves 1991, 1994). Average brood size was 3.4 (range 1-7) in Idaho (n=24) (Cassirer and Groves 1991).

In British Columbia, 41 broods of all ages ranged in size from 1 - 10 (1Y-3, 2Y-3, 3Y-5, 4Y-11, 5Y-14, 6Y-2, 7Y-1, 8Y-1, 10Y-1); the brood with 10 young was apparently from a single female (Campbell *et al.* 1990).

In Alaska, numbers of young per breeding female and per adult female were respectively 1.5 and 0.8 in 1979, and 0.6 and 0.3 in 1980; patagial tags on adults appeared to have caused poor reproductive success (Dzinbal 1982). Non-breeding frequency of females was 47% in 1979 and 50% in 1980 (Dzinbal 1982).

In Iceland, 1.73 (85:49) and 2.43 (120:49) young per adult female were successfully raised during 1975 and 1976, respectively (Gardarsson 1979). In an increasing population in Iceland, productivity ranged from 0.1 to 3.3 ( $\bar{x} = 1.1$ ) ducklings fledged per hen per year over 15 years (Gardarsson and Einarsson 1991). These results were similar to those of Bengtson (1972), who reported 0.0 to 3.8 young per adult female on 4 rivers during 4 years.

***Proportion of total females that rear at least one brood to nest-leaving.*** Harlequin Ducks raise only a single brood each year. The proportion of females successfully raising a brood in a single year varies widely between years. In Montana during 1995, only 23% of 48 females successfully raised a brood (Table 5); stream surveys between 1974 and 1995 found that 305 females raised 118 broods for an average of 38.7% (range 7-55%) (Table 6). From throughout their range, the percentage of females which successfully raise a brood varies from 7-56% (Bengtson and Ulfstrand 1971, Kuchel 1977, Wallen 1987, Cassirer and Groves 1991, this report).

Table 5. Harlequin Duck reproduction in 1995 for streams with both pair and brood surveys.

<u>Stream</u>	<u>#Adult Females</u>	<u>#Broods</u>	<u>#Young</u>
<b>Flathead Drainage</b>			
McDonald Creek	22	1	1
Spotted Bear River	2	1	5
Sullivan Creek	2	0	0
Trail Creek	6	0	0
Drainage Total	32	2	6
0.06 Broods per adult female			
0.19 Young per adult female			
3.00 Young per brood			
 <b>Lower Clark Fork Drainage</b>			
Marten Creek	5	2	11
Rock Creek	# 1	1	5
Swamp Creek	3	2	10
Vermilion River	2	2	5
Drainage Total	11	7	31
0.64 Broods per adult female			
2.82 Young per adult female			
4.43 Young per brood			
 <b>Other</b>			
Callahan Creek	1	0	0
Grave Creek	4	2	5
Drainage Total	5	2	5
0.40 Broods per adult female			
1.00 Young per adult female			
2.50 Young per brood			
 <b>GRAND TOTAL</b>			
	48	11	42
0.23 Broods per adult female			
0.87 Young per adult female			
3.82 Young per brood			

<sup>#</sup> = Probably an underestimate

<sup>\*</sup> = Two unknown age ducks also present; may have been juveniles.

Table 6. Harlequin Duck reproductive parameters for 1974-75 (Kuchel 1977) and 1989-1995.

Year	# adult females	# broods	# young	broods per ad. female	young per ad. female	young per brood
1974	11	3	12	27%	1.09	4.00
1975	15	1	2	7%	0.13	2.00
1989	13	7	41	54%	3.15	5.86
1990*	31	17	65	55%	2.10	3.82
1991*	37	9	31	24%	0.84	3.44
1992**	71	39	132	55%	1.37	3.38
1993#	49	21	59	43%	1.20	2.81
1994#	30	10	40	33%	1.33	4.00
<u>1995#</u>	<u>48</u>	<u>11</u>	<u>42</u>	<u>23%</u>	<u>0.87</u>	<u>3.82</u>
Total	305	118	424			
Mean				38.7%	1.39	3.59

\* includes data from the Rocky Mountain Front (Diamond and Finnegan 1992, 1993)

# Includes data from Ashley (1994a, 1994b, 1995, pers. comm.)

**Sex ratio.** During the spring pair season, a sex ratio of 1.51:1 has been observed in Montana (m:f, n = 600) (Table 7). Table 7 is based on independent male observations during the period 27 April - 30 May; when more than one survey was done during a single season on a single stream, the survey with the maximum number of females was included in Table 7. Cassirer (1995) found a spring adult sex ratio of 1.31:1 (m:f, n = 81) in 1995 on Idaho streams. In Banff National Park, Alberta, sex ratios varied from 1.37:1 in May to 1.81 in June (Smith 1996). In Iceland, sex ratios on the breeding grounds varied from 1.17 - 2.33:1 during 5 summers in late May - early June (Bengtson 1966, Bengtson 1972, Gardarsson 1979).

In coastal British Columbia, the apparent sex ratio is 1.5:1 (544 birds) in winter, declining to 1.4:1 (297 birds) in March-April (Campbell *et al.* 1990); this grows to 4.3:1 in May, and by July, when adult females are still on the breeding streams, it reaches 18.2:1 (1633 birds).

Table 7. Sex Ratios of Harlequin Ducks on Breeding Streams during pair season in Montana.

Location	# Males	# Females	Year (s)	Citation
Montana (NW)	10	4	1990	Fairman and Miller 1990
Montana (NW)	1	1	1991	Lee and Genter 1991
Montana (NW)	1	1	1989	Miller 1989
Montana (RMF)	50	26	1991	Diamond and Finnegan 1992
Montana (RMF)	44	30	1992	Diamond and Finnegan 1993
Montana (SW)	6	3	1990	Markum and Genter 1990
Montana (NW)	14	12	1990	Carlson 1990
Montana (NW)	11	6	1989	Fairman, Genter and Jones 1989
Montana	37	23	1995	this survey
Montana	27	17	1994	Reichel and Genter, unpubl. data
Montana	19	12	1993	Reichel and Genter, unpubl. data
Montana	10	8	1992	Reichel and Genter, unpubl. data
Glacier NP	19	18	1993	Ashley 1994a
Glacier NP	29	27	1994	Ashley 1994b
Glacier NP	35	25	1995	Ashley 1995
Glacier NP	22	11	1974	Kuchel 1977
Glacier NP	26	15	1975	Kuchel 1977
TOTAL	361	239		

#### LIFE SPAN AND SURVIVORSHIP

In Montana, 249 Harlequins (39 adult males, 53 adult females, 157 juveniles) have been banded from 1991 through 1995. Adult males returned to the breeding streams when they had lived during the previous year on 53% ( $n=51$ ) of occasions, while females returned at a rate of 57% ( $n=81$ ). The higher female rate may be due to the fact that a male may mate with a new female, which could lead him to a new stream, so that he would not be seen on the previous year's stream. For comparison with other studies, 50% of males ( $n=30$ ) and 55% of females ( $n=30$ ) returned at least 1 year following marking. Of 40 females marked as adults through 1993, 6 had a gap of one breeding season between resightings on the breeding grounds; none marked through 1992 ( $n=23$ ) had a two season gap. In 5 cases ( $n=21$ ), males marked as adults had a gap of one breeding season between resightings, and in 1 case ( $n=9$ ), a two season gap. Of 58 juveniles marked in 1992, at least 16 females and 4 males were alive in 1994, and 11 females and

3 males were alive in 1995; of 42 juveniles marked in 1993, at least 1 female and 1 male were alive in 1995. All males known to be alive were seen on the wintering grounds only.

In Glacier National Park, all mortality of ducklings (through fledging) took place in the first three weeks of life (Kuchel 1977). This is similar to the findings of Bengtson (1966, 1972), who reported that of 7 broods totaling 37 ducklings, 24 survived one week, and 19 survived two weeks; little mortality was seen after two weeks. Bengtson (1972) reported that survival of ducklings ranged from 40-76% on 3 streams over 5 years. An extreme example showing little mortality after 1-2 weeks is a brood of 5 Class Ib young (8-15 days-old), which was first seen on Marten Creek, Montana, on 10 July 1995, without an adult female present. All survived and were nearly flying on 28 July 1995.

In Idaho, 63% of adults ( $n=30$ ) returned at least 1 year; male and female rates were not significantly different (Cassirer and Groves 1994); one duck marked as an adult in 1988 returned through 1993 (minimum 7 years old). No ducklings marked from 1988-1991 were re-observed ( $n=27$ ). In Wyoming, 40% of marked adults returned to breeding streams (Wallen 1993). At least 5 females of 103 ducklings banded in 1987-1990 have returned and nested successfully (Wallen 1991). The oldest known Wyoming bird was marked as a duckling in 1985 and recaptured in 1991 (Wallen 1993). In Alaska, 30% (8) of adult females and 30% (3) of adult males marked were relocated the following year (Dzinbal 1982:62).

In Iceland, 64% (20) of adult females and 48% (13) of adult males, marked with nasal discs, were relocated the following year (Bengtson 1972). Hatching success in Iceland averaged 87%, and ranged from 84% to 91% in four years (Bengtson 1972).

## CAUSES OF MORTALITY

**Causes of death.** Reproduction in Montana in 1995 was one of the poorest on record (Table 5, 6). Table 5 shows the North Fork Flathead drainage reproduction to be almost non-existent, while reproduction on Lower Clark Fork streams was near average. An extremely heavy spring storm in the North Fork caused streams to exceed 100-year flood levels (M. White pers. comm. *in* Ashley 1995); this heavy storm and flood did not hit the Lower Clark Fork area. Throughout Montana, high water during early summer runoff has been associated with low productivity by a number of studies (Kuchel 1977; Diamond and Finnegan 1992, 1993; Reichel and Genter 1993, 1995). Possible explanations for the negative correlation of survival with runoff include females not nesting due to high water and/or poor feeding; destruction of nests within the floodplain; or loss of juveniles due to drowning, separation from the female, inability to feed effectively, or hypothermia.

In Idaho, productivity was negatively correlated to June stream flow ( $r = -0.93$ ,  $p = 0.006$ ) (Cassirer and Groves 1995). Wallen (1987) reported that neither of two broods seen prior to a severe July rainstorm, which raised a creek level 0.6 m within 2 hours, was ever seen again; however, he generally felt that drought in the Grand Tetons was more limiting to reproductive success than was flooding. Dzinbal (1982) reported that higher spring run-off was associated with lower reproduction in a two-year study in Alaska.

Bengtson (1972) found that very low duckling survival coincided with adverse weather and with very low abundance of blackflies, the preferred food in the study area.

In coastal waters, Harlequins are occasionally caught by the bill and drowned by large mussels and clams (Turner 1886 *in* Philips 1925).

**Exposure and predation.** Predation on eggs by river otters (*Lutra canadensis*) and by black bears (*Ursus americanus*) has been reported in Washington (Jeff Foster unpubl. data, *in* Schirato 1993).

Following mink (*Mustela vison*) introduction in Iceland, Harlequin populations substantially declined in several areas and changed nesting sites in others (Bengtson 1966). Predators including the Raven (*Corvus corax*) (5), mink (2), Parasitic Jaeger (*Stercorarius parasiticus*) (1), and arctic fox (*Alopex lagopus*) (1) took 9 nests in Iceland (n=89) (Bengtson 1972). Additionally, 2 nests were deserted, and 1 failed to hatch (Bengtson 1972). Arctic Skuas were seen taking 2 chicks in Iceland (Bengtson 1972).

## RANGE

**Dispersal from natal stream.** In Montana, juveniles apparently leave the natal stream soon after fledging. At least 13 broods fledged prior to leaving the breeding stream (n=69) and many more may have waited that long, but follow-up surveys were not done. In McDonald Creek, Montana, Kuchel (1977) reported that at least one brood had left prior to fledging, apparently swimming across McDonald Lake and drifting downstream. In Alaska, one brood was reported to use Stellar Lake when very young, moving down to Stellar Creek when older, and finally using Stellar Bay and the lower tidal portion of Stellar Creek when Class IIc-III (Dzinbal 1982).

**Fidelity to natal stream.** Of 100 ducklings marked in 1992-93 in Montana, 14 females are known to have survived at least 2 years. Of the 14 surviving females, 5 were reported only from their natal stream, 1 only from the coast, and 8 from both the coast and the natal breeding stream. Seven males marked as juveniles were seen only on the coast; none have been reported from their natal stream (Ashley 1995, this report). In Glacier National Park, 2 of 5 ducks banded as juveniles in 1974 returned to the natal stream in 1976; both were females (Kuchel 1977).

No ducklings marked from 1988-1991 in Idaho have been re-observed (n=27) (Cassirer pers. comm.).

**Adult fidelity to breeding stream.** In Montana, all 3 males marked as adults and later seen on the wintering grounds returned to the breeding grounds the following year. A single female (n=47), marked on McDonald Creek Montana in 1992 and not seen there since, was observed on Hornby Island, British Columbia, in March of 1995 and 1996. Given the intensive survey effort in Montana during that period (Figure 1, Appendix G), it is likely that she had substantially shifted her breeding location since being originally marked. This case constitutes the only evidence that breeding streams may be abandoned.

## POPULATION STATUS

**Estimates or counts of density.** Densities of Harlequins on breeding streams range from 0.05 pairs/km on a stream in Montana (Diamond and Finnegan 1993) to 8.5 pairs/km on part of the Laxa River in Iceland (Bengtson and Ulfstrand 1971). In Montana, pair density on a 16 km section of McDonald Creek was 0.67/km in 1974 and 0.91/km in 1975 (Kuchel 1977). On the Rocky Mountain Front, densities ranged from 0.05 pairs/km to 0.21 pairs/km (Diamond and Finnegan 1993).

In Idaho, pair densities averaged 0.19/km (range 0.08-0.57) of occupied streams surveyed (Cassirer 1995). From 1990 through 1992, densities there averaged 0.06-0.53 pairs/km ( $\bar{x} = 0.22$ ) (Cassirer 1993). In Oregon, densities of adults per km surveyed ranged from 0.07 to 1.21;

densities per km surveyed including juveniles ranged from 0.07 to 2.37 (Thompson *et al.* 1993, 1994).

On the Bow River in Banff National Park, densities observed were the highest known from streams in North America, ranging from 2.4 ducks/km on a 15 km reach to 6.2 on a 16 km reach (Smith 1996).

On Kodiak Island, Alaska, density of breeding Harlequin pairs ranged from 0.63 pairs/km along the Ayakulik River to 1.98-7.24 birds/km in 3 coastal bays (Zwiefelhofer 1994). Dzinbal (1982) reported 1.3-1.8 pairs/km on two small coastal streams in Alaska.

On the Laxa River in Iceland, Harlequins are apparently present at densities higher than other known stream populations (Bengtson 1972). Twenty populations in Iceland ranged from 0.2 to 8.5 pairs/km, with an average of 0.9 pairs/km (Bengtson and Ulfstrand 1971, Bengtson 1972).

In eastern Siberia, Kistschinsky (1968 *in* Bengtson 1972) found 1.1 pairs/km and 0.8 - 1.2 broods/km.

**Numbers.** Numbers estimated by most recent publications and reports are listed in Table 8. Cassirer *et al.* (1996) reported that the maximum percentage of pairs observed during surveys done under optimal conditions was 69%. This is similar to the 75% (range 67-81%) reported by Ashley (pers. comm.) on McDonald Creek during 1993-1996. Estimated pair numbers for Montana (Table 8) were calculated using 72%. However, that percentage was not used to adjust minimum numbers on streams when a high proportion of ducks were individually marked and multiple surveys took place in several years; in those cases 90% was used. A minimum of 151 pairs of ducks nest in Montana, which represents an estimated 198 total pairs (Table 8, Appendix F).

The largest single reported Harlequin Duck occurrence (see **Breeding Range**) is from the Bow River drainage in Banff National Park, Alberta, where, using a mark/resight model, 215 individuals were calculated to occur during 1995 (Smith 1996).

Table 8. Estimated numbers of Harlequin Ducks.

Location	Estimated Breeding Population	Minimum # Pairs	Estimated # Pairs @	Citation
Atlantic Ocean	10,000			
Greenland	5,000			Montevecchi et al. 1995
Iceland	3-5,000			Montevecchi et al. 1995
North America	<1,000			Goudie 1991
Pacific Ocean (Asia)	50-100,000			Goudie et al. 1994
Russia	50-100,000			Goudie et al. 1994
Japan	<100			Brazil 1991
Pacific Ocean (North America)	165,000			Goudie et al. 1994
Lower 48 U.S. States	2,391	563	797	
Washington		274	399	Schirato 1994
Montana		151	198	this report
Oregon		50	72	Thompson et al. 1993
Idaho		48	70	Cassirer et al. 1996
Wyoming		40	58	Cassirer et al. 1996

<sup>@</sup> After Cassirer et al. (1996) except for Montana (see text)

**Trends.** Little long or short term data is available. In Montana, the long-term trend appears to be downward. Occurrences with larger populations (>5 pairs) appear to be stable over the last 4-8 years, while some small occurrences appear to be declining or have recently gone extinct (see DISTRIBUTION - HISTORICAL CHANGES); however, this data has not been statistically analyzed. In general, the recent North American Pacific populations trend is not clear-cut but generally appears to be declining. Christmas bird counts in British Columbia show declines at 5 locations and increases at 3; the increases, however, may be due to increasing numbers of observers in urban areas (Harlequin Duck Working Group 1993). In Alberta, breeding Harlequins are significantly declining on the Maligne River in Jasper National Park (Harlequin Duck Working Group 1993). Seven streams in Northern Idaho appear to be stable, though 1 stream shows a decrease and one shows an increase; all populations are relatively small (Cassirer 1995). In Wyoming, breeding populations appear to be stable in Grand Teton National Park (Harlequin Duck Working Group 1993). In Alaska, a major population in Prince William Sound has been decimated by the *Exxon Valdez* oil spill (Goudie et al. 1994). The Asian Pacific population appears to be declining rapidly in eastern Siberia (Goudie et al. 1994).

The Atlantic population has undergone and is continuing to undergo significant declines (Harlequin Duck Working Group 1993). Trends in the Greenland and Iceland populations are unknown.

## POPULATION REGULATION

A simple model using "guesstimates" for values of survival and fecundity was developed by Goudie and Breault (1994). They estimated that at 85% adult survival, the population would grow at a rate of 6%/year. Simulations indicate that the model was most affected by adult survival; an increase of 3% in mortality may not be sustainable over the long term (Goudie and Breault 1994).

## **CONSERVATION AND MANAGEMENT**

### EFFECTS OF HUMAN ACTIVITY ON HARLEQUIN DUCK POPULATIONS, REPRODUCTION, AND BEHAVIOR

*Disturbance on the breeding grounds. On and near shore.* Kuchel (1977) found that broods less than 4 weeks old avoided areas with human access and selected areas that were distant from access or inaccessible ( $p < 0.05$ ) on McDonald Creek in Glacier National Park. This was not true of adults during May and early June when fewer park visitors were present. More recently, Ashley (1994) found that Harlequins used inaccessible areas in greater proportions than the availability of those areas, though not significantly so; this data is conservative in that surveys took place in the early morning prior to the vast majority of visitor use. Most Harlequins left accessible stream reaches when visitor use reached greater than minimal levels. Ashley (1994) found that males were displaced by human activity to a greater extent than were females, which he speculated could be due to any or all of three reasons. First, females were likely born in Glacier National Park with its many visitors, and were therefore more habituated to humans than were males, which were likely born at other locations. Second, females spend more time each year on McDonald Creek during higher visitation periods than do males, and may thus be more habituated to human contact. Third, females are more cryptically colored and therefore less likely to attract casual visitor attention.

On the Rocky Mountain Front in Montana, only 15% of sightings were in areas that were inaccessible (>50 m from established areas of human activity, not accessible by trail) (Diamond and Finnegan 1993). Of the accessible areas, 51% were >50 m from a trail, 21% were 10-50 m from a trail and 13% were <10 m from a trail; it should be noted that >90% of this area is roadless. Visitor use is highest along the South Fork Sun River: 500 people/month use the trail in July and August (Diamond and Finnegan 1993).

In Grand Teton National Park, Wyoming, 95% of Harlequin observations were in backcountry areas, accessible only by trail (Wallen 1987). Within the backcountry however, Harlequins used areas with moderate (5-9 people/day) to heavy (>10 people/day) human use more than they used areas with less human use; Wallen (1987) suggested that these observations may have been the result of the presence of many high gradient, inaccessible stream reaches which lacked the habitat features preferred by Harlequins.

In Yellowstone National Park, a three-year study was done to assess visitor impacts to Harlequin use at LeHardy Rapids, where it appeared that duck use had decreased due to high visitor use (McEneaney 1994). The area was closed to visitors from 1 May - 7 June 1991-1993, and Harlequin Duck use increased; however, a historical nest site in the immediate vicinity was

not reoccupied (McEneaney 1994). Beginning in 1995, visitors were to be confined to a boardwalk.

In Idaho, Harlequin Ducks were typically found at sites more than 50 m from road or trail access (adults = 75%, broods = 80%) (Cassirer and Groves 1994). Pair densities there were lowest on streams most accessible to human activity (Cassirer and Groves 1991). In Oregon, duck sightings were much closer to sites with established human activity, with 48% being within 10 m of activity sites (roads 48%, fishing 29%, hiking 19%) (Thompson *et al.* 1993).

In Washington, a cavity nest with the opening 2.4 m high was located 1.3 m from a trail (in 1991) and within a back country corral (1992); the depth of the nest cavity (61 cm) prevented the hen from seeing outside and hid her from view (Cassirer *et al.* 1993). Two nest cavities in Idaho however, were located in areas seldom used by humans, about 150 m from logging roads (Cassirer *et al.* 1993).

In Jasper National Park, visitor use by hikers, nature tours, fishermen, tourists, and boaters (see below) on the Maligne River drainage has increased substantially in the past decade; during that period, Harlequin Duck numbers have decreased substantially (Clarkson 1992, Hunt 1993). It was felt that disturbance was likely the cause of the decline, and recommendations were therefore made to revise methods of controlling rafting including: closing particular river reaches to boating and to other human activity; and not issuing new business licenses/special activity permits which would increase the current level of human activity in the area (Clarkson 1992).

*Within the stream.* Cassirer and Groves (1991) reported that 5 of 11 streams where Harlequin breeding had been reported or confirmed during 1988-1990 were closed to fishing or did not open to fishing until 1 July.

Wallen (1987) reported that fishing seemed more disruptive to Harlequins than hiking. Harlequins were found to avoid humans on the bank or in the stream bed; birds would typically swim or dive downstream past people, keeping partially submerged when past and watching behind themselves while moving out of the area. Two hens with broods abandoned a section of one creek when fishing pressure increased in August; they moved to a nearby creek which drained into the same lake, where fishing was not observed (Wallen 1987).

*In boats.* Prior to significant raft and canoe use on rivers in Jasper and Banff, Holroyd (1979) warned of the potential negative effects of intensive river use on Harlequin Ducks. Since that time, commercial whitewater rafting in Jasper National Park has frequently exposed pre-nesting and perhaps nesting ducks to disturbance (Clarkson 1992, Hunt 1993). Only six commercial trips took place there in 1986, but increased to over 1500 trips/year by 1990 (Clarkson 1992, Hunt 1993). This was significantly correlated with declining Harlequin Duck numbers during the period 1986-1992 (Hunt 1993). Additionally, the mean monthly abundance of Harlequin Ducks is significantly and negatively correlated with the number of rafting trips per month (May, June, July) from 1986-92 (Hunt 1993).

On the Maligne River in 1993, Harlequins were displaced by rafts in 87% of 91 encounters; duck reactions included flying (60%) and swimming (19%) away from the rafts (Clarkson 1992). Birds usually took flight if a raft was on a collision course with a bird, was within 1-15 m of a bird, or if the raft crew was acting "boisterously" as they passed the duck (Clarkson 1992). Hunt (1993) recommended closure of the river to rafting in an attempt to restore historic population levels of Harlequins. He listed other less commercially disruptive actions which could possibly help stem the decline in Harlequins, including: 1) reducing the

amount of time each day that rafting was permitted; 2) reducing the number of allowed launch times each day; and 3) reducing the length of the river use season (Hunt 1993).

On the Bow River in Banff National Park, reaction to canoes by Harlequins was considerably less (Smith 1996). In 158 encounters, 62.6% of ducks had no reaction, 16.5% swam away, 11.4% flew away, and 9.5% hid (Smith 1996). The considerable difference in reactions between ducks on the Bow and Maligne Rivers is probably due to the fact that the Bow is substantially wider and splits in channels in numerous locations (Smith 1996).

Cassirer and Groves (1991) reported that nesting appeared to occur on stream reaches above those used by rafts on the two regularly boated Harlequin Duck streams in Idaho. Heavy whitewater rafting is believed to have caused the extirpation of Harlequins on the Methow River in Washington (Brady pers. comm. in Clarkson 1994).

**Noise.** No data available.

**Collecting and trapping.** Collecting permits have been issued in Montana (1), Washington, and Alaska. In Washington, a permit for 15 was issued as recently as 1992 and permits for up to 50 had been issued in previous years (Schirato 1993). There is a market for Harlequins in the avicultural trade, with pairs valued at \$2,000 or more (C. Pilling, aviculturalist, pers. comm., in Harlequin Duck Working Group 1993).

In Iceland, egg collecting was extensively carried out in some areas through the mid-1960s, both for consumption and for breeding purposes; egg collecting is now prohibited (Bengtson 1972).

Capture of 465 Harlequin Ducks in British Columbia coastal waters resulted in 5 mortalities, 3 by drowning and two by heat prostration (Clarkson and Goudie 1994). In Montana, the mist-netting of over 250 Harlequins on breeding streams has resulted in 1 duckling death and in 1 adult leg injury.

**Shooting.** Hunting was the likely cause of the decline of the eastern North American Harlequin Duck population (Philips 1925, Palmer 1949). This was likely due to the fact that they are less wary than other sea ducks while on the coast (Philips 1925, Palmer 1976) and the fact that they forage in shallow water close to shore.

In Alaska, Harlequins are harvested by both recreational and subsistence hunters (Rothe 1994). The extent of hunting in the Pacific North American population appears to be low, with the exception of a few local areas in Alaska. No band returns from hunting have been reported out of more than 249 birds banded on breeding areas of Montana; however, a banded bird was found to have holes in the webbing of the foot apparently caused by pellets from a shotgun (Reichel and Genter 1994).

**Fishing.** Harlequins have been found entangled in fishing line in Glacier National Park on McDonald Creek (Ashley 1994) and in Jasper National Park on Maligne Lake (Clarkson 1992). A Harlequin has also been found with a fish hook lodged in its throat (Cassirer, pers. comm. in Clarkson 1992).

**Pesticides and other contaminants/toxics.** Thousands of Harlequins were killed or injured as a result of the *Exxon Valdez* oil spill of 24 March 1989 (Patten 1993 in Clarkson 1994). Later, productivity in western Prince William Sound, where oil remained, was nearly zero during 1989-1993; reproduction, however, was substantial in portions of eastern Prince William Sound which were not directly affected by the oil spill (Patten 1994). Petrochemicals were found in the proventriculus, liver and bile in Harlequins in western Prince William Sound and southwestern Kodiak Island; these were probably introduced via feeding on blue mussels (*Mytilus adulis*), an important food of Harlequins (Patten 1994). A relatively small oil spill in

1991 by the *Tenyu Maru* threatened approximately 10% of the Harlequins wintering in Washington (G. Schirato pers. comm. in Clarkson 1994). Even in the remote western Aleutian Islands where most Harlequin winter, sparse but wide-spread oil pollution is a potential threat (Byrd *et al.* 1992).

Wintering Harlequins concentrate in several areas along the Pacific coast for feeding and molting. Among these concentration areas is the east shore of Vancouver Island where toxic pollutants are abundant (Waldichuk 1983 in Clarkson 1994). Additionally, commercial, industrial, and recreational development are growing rapidly in this area.

#### ***Degradation of habitat: breeding and wintering.***

**Breeding.** In 1992, a gas pipeline project was started which crosses the Moyie River in Idaho 8 times (Cassirer 1995). Because Harlequins were known to use this stream, a study was begun when siltation was noted from construction. The study showed that the siltation caused a decline in the Harlequins' macroinvertebrate food source; no young were successfully raised that year (Cassirer 1995). Recovery of macroinvertebrates was expected to occur within a year; indeed, Harlequins successfully bred the following year. The effects of the construction could have been minimized if the work had been done in late summer (after 1 September) or fall. The long term effect of the loss of one year's production on this already small population is yet not known (Cassirer 1995). However, Harlequins did attempt to breed (unsuccessfully) despite the disturbance and did not move to nearby streams.

## **MANAGEMENT**

### ***Federal***

***Fish and Wildlife Service.*** Neither the Atlantic nor Pacific populations are listed as Threatened or Endangered in the United States. The Harlequin Duck was listed as a Category 2 Candidate Species prior to 1996 at which time that Category was administratively eliminated. It is legally hunted in the Pacific states and provinces under the Migratory Bird Treaty Act and under state, provincial and federal regulations. Hunting is closed on the Atlantic flyway.

***National Park Service.*** A seasonal boating closure was instituted on McDonald Creek above Lake McDonald in Glacier National Park in 1995 to protect Harlequin Ducks; the stream is closed to boating from 1 April through 30 September (J. Ashley pers. comm.). To protect wildlife, no boating on rivers is allowed in Yellowstone National Park. No U.S. National Park Service management plan exists for the Harlequin Duck.

***Forest Service.*** The Harlequin Duck is a Sensitive Species in the Northern, Rocky Mountain, and Pacific Northwest Regions. Forest Service policy states that Sensitive Species should be managed to ensure that populations do not become Threatened or Endangered.

***States/Heritage Programs.*** The Harlequin Duck is classified as a state sensitive species in Oregon, a priority habitat species in Washington, and a species of special concern in Idaho and Montana.

***Other legal status.*** The Atlantic population of the Harlequin Duck is listed as Endangered by the Canadian Wildlife Service.

***Mitigation procedures.*** None found.

## **PRIORITIES FOR FUTURE RESEARCH**

The following are among the top future research priorities and are primarily a subset of those listed by the Harlequin Duck Working Group (1993) and by Cassirer *et al.* (1996). The Montana Natural Heritage Program has developed research proposals to address the priorities for those questions associated with the breeding grounds and migration and is pursuing funding for them; these are available from the Natural Heritage Program.

### 1) What are the impacts of human disturbance on breeding and wintering Harlequin Ducks?

Several independent studies have documented the sensitivity of Harlequin Ducks to human disturbance, primarily through the relationship of sighting locations to the accessibility of those locations (Kuchel 1977, Wallen 1987, Diamond and Finnegan 1993, Cassirer and Groves 1991, 1994, Clarkson 1992, Ashley 1994). Specifically, boating has been shown to have a significant negative correlation with numbers of ducks present in one area on a medium-sized stream (Clarkson 1992, Hunt 1993). Observations in other areas tend to support this conclusion (Cassirer and Groves 1991, Brady pers. comm. *in* Clarkson 1992) though it may not be the case in very large streams (Smith 1996). Fishing and human presence have also been suggested as causes of disturbance; however, though specific examples exist for both disturbances, statistical data analyses are lacking (Wallen 1987, McEneaney 1994, Cassirer and Groves 1991).

Other than for boating (Clarkson 1992, Hunt 1993), wide-scale analyses have not yet been attempted nor have analyses of the effects of most specific kinds and amounts of human activities. Several specific studies should be performed to address these questions.

Initially, wide-scale data on Harlequin streams is required, including productivity; population size; length of stream segments used during pair and brood seasons; categories and locations of land ownership of the streams; hydrogeological properties of the streams; habitat characteristics of the streams; and current human use of the stream (by roads, trails, structures, activity, etc.). A first step will be to see which of this information is already available and what is lacking that needs to be gathered in the field. For example, data regarding population size and length of stream segments used is already in place, while data regarding hydrogeological properties, habitat of the streams, and current human use will require preliminary information gathering to determine what is available. Unused and/or unknown streams that fit physical parameters of used streams can then be selected and compared in respect to kind and amounts of disturbance/accessibility.

Following wide-scale analyses, Harlequin response to humans requires evaluation; initial responses to surveyors could be recorded. Note that this would only provide immediate, in-sight response of birds seen; presumably some birds would react prior to the surveyor seeing them and thus not be observed at all. Nor would such a study reveal length of time or distance moved in reaction to disturbance. A more precise but intrusive method would be to use radiotelemetry on the birds. Radio-telemetry would additionally provide more accurate data on use of habitat types and locations relative to human development/access points.

Finally, when actions are taken on Harlequin streams, monitoring to determine effects of those actions should be implemented, thereby providing for adaptive management and prevention of future mistakes. Specific land management or development actions on Harlequin streams should be proceeded by at least two years of baseline marking and surveying for population size

and productivity, areas used at different seasons, habitat evaluation, and pre-action levels of human activity and development. Monitored should continue to occur during and following the action. Actions which particularly need attention include road, campsite, and trail construction and upgrading, including any increased accessibility and changes in human use of the area; actions which could result in changes to flow regimes or water quality, such as mining, road building, timber harvest, industrial development, and water/hydroelectric development; changes in fishing regulations which could change fishing use of the area; and building of structures such as industrial areas, dams, or houses which will increase the access and use of a Harlequin stream. Possibilities for mitigation and habitat restoration can be explored during these projects.

2) What is the extent and nature of movements in breeding and wintering areas?

This information is needed to determine the possibilities for naturally recolonizing new and historic Harlequin occurrences; naturally supplementing existing occurrences, particularly small populations; and the strength of natal and adult fidelity to particular sites. This information is necessary in order to successfully model Harlequin populations and their stability, with both breeding and wintering grounds data incorporated.

Radio-telemetry may give quick results from the standpoint of local daily movements; however, long distance ( $>5$  km) movements may be relatively rare, and with limited numbers of ducks radioed, may not be best for long distance movement detection. For long distance and moves between years, visibly marking birds is best.

Determining fidelity to natal areas will be a long term project; Montana has the strongest start, with 250 birds banded on the breeding grounds since 1992. Sufficient information for preliminary modeling should be available following the 1996 field season. Sufficient information for final modeling could then be available following the 1998 field season, if funding is continued for the project to that point.

Much data is now available in relation to wintering grounds movements and additional data is currently being collected in Washington, Alaska, and British Columbia. Sufficient information for use in detailed population modeling should be available within 2 years. For an accurate model, information is necessary from both the breeding and wintering grounds.

3) Are distinct metapopulations (such as a Rocky Mountain breeding population) identifiable within the Pacific range of the Harlequin Duck?

A knowledge of the degree of genetic differences among and within wintering and breeding subpopulations would allow an assessment of the appropriate management units for various Harlequin conservation strategies. Dan Esler, Alaska National Biological Service, is currently examining this question, primarily as it applies to wintering areas.

4) What are the critical habitat components limiting Harlequin Duck breeding and wintering populations?

Harlequin Ducks use a wide variety of habitats on the breeding grounds, from forests to tundra. Habitat usage should be documented over a large number of study areas to identify common habitat components for comparison to available habitat; both large and small scale components should be considered.

5) How and why do productivity and survival change over time and different areas, and what are the relative impacts of these changes on populations?

Long term studies are needed to determine population parameters for incorporation into population models (with information from movements on the breeding and wintering grounds). Needed population parameters include: productivity; age-related survival; recruitment; age(s) at first breeding and/or successful breeding; age(s) last breeding; life expectancy; and causes and timing of mortality. This information can only be provided via long-term studies involving marked birds on both the breeding and wintering areas. We are currently in an optimum position to complete studies needed on the breeding grounds, with 4 years of data on the Montana breeding population. Combined with the continued marking and study of coastal populations by Alaska, Washington, Oregon, and British Columbia, many of these parameters may be known by the end of 1997.

The most difficult question to be answered involves the causes of mortality, which is not tractable given current technology. If and when small, long range mortality transmitters are available for ducks, this topic should be pursued.

6) What are the characteristics of Harlequin Duck migration? How well defined are migratory staging areas and migration corridors?

This question may not be tractable given current technology. If and when small, long range mortality transmitters are available for ducks, this topic should be pursued. Some answers may come from large scale marking of individuals, and perhaps by relocating radioed birds.

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## **Appendices**

## **Appendix A.**

### **Data Forms**

Harlequin Duck Survey Form. \_\_\_\_\_ of \_\_\_\_\_

Date \_\_\_\_\_ Time \_\_\_\_\_ Surveyor(s) \_\_\_\_\_  
(Start/Finish)

Stream \_\_\_\_\_

Include map with exact area(s) surveyed on back of this page

Weather \_\_\_\_\_

(Temp., wind dir & speed, cloud cover, precip last 24 hrs)

Accessibility? \_\_\_\_\_

Group # \_\_\_\_\_ # Individuals \_\_\_\_\_  
(Put on map)

Sexes & Ages \_\_\_\_\_

Marked? \_\_\_\_\_

Accessibility? \_\_\_\_\_

Group # \_\_\_\_\_ # Individuals \_\_\_\_\_  
(Put on map)

Sexes & Ages \_\_\_\_\_

Marked? \_\_\_\_\_

Accessibility? \_\_\_\_\_

Group # \_\_\_\_\_ # Individuals \_\_\_\_\_  
(Put on map)

Sexes & Ages \_\_\_\_\_

Marked? \_\_\_\_\_

Accessibility? \_\_\_\_\_

NOTES:

Harlequin Duck Banding Form.

Date \_\_\_\_\_ Location \_\_\_\_\_

Sex \_\_\_\_\_ Age \_\_\_\_\_ T \_\_\_\_\_ N, R \_\_\_\_\_ W, Section \_\_\_\_\_  
Nasal Saddles Color Bands  
Band # \_\_\_\_\_ Lft \_\_\_\_\_ Rt \_\_\_\_\_ Lt \_\_\_\_\_ Rt \_\_\_\_\_

Weight \_\_\_\_\_ Wing chord \_\_\_\_\_ Tail \_\_\_\_\_ Tarsus \_\_\_\_\_

Molt \_\_\_\_\_

Notes \_\_\_\_\_  
(with other ducks? marked, sex, age? etc.)

+++++

Date \_\_\_\_\_ Location \_\_\_\_\_

Sex \_\_\_\_\_ Age \_\_\_\_\_ T \_\_\_\_\_ N, R \_\_\_\_\_ W, Section \_\_\_\_\_  
Nasal Saddles Color Bands  
Band # \_\_\_\_\_ Lft \_\_\_\_\_ Rt \_\_\_\_\_ Lt \_\_\_\_\_ Rt \_\_\_\_\_

Weight \_\_\_\_\_ Wing chord \_\_\_\_\_ Tail \_\_\_\_\_ Tarsus \_\_\_\_\_

Molt \_\_\_\_\_

Notes \_\_\_\_\_  
(with other ducks? marked, sex, age? etc.)

+++++

Date \_\_\_\_\_ Location \_\_\_\_\_

Sex \_\_\_\_\_ Age \_\_\_\_\_ T \_\_\_\_\_ N, R \_\_\_\_\_ W, Section \_\_\_\_\_  
Nasal Saddles Color Bands  
Band # \_\_\_\_\_ Lft \_\_\_\_\_ Rt \_\_\_\_\_ Lt \_\_\_\_\_ Rt \_\_\_\_\_

Weight \_\_\_\_\_ Wing chord \_\_\_\_\_ Tail \_\_\_\_\_ Tarsus \_\_\_\_\_

Molt \_\_\_\_\_

Notes \_\_\_\_\_  
(with other ducks? marked, sex, age? etc.)

+++++  
NOTES:

**HARLEQUIN DUCK OBSERVATION FORM**  
 (Record data for the site where ducks are first seen!)

Date \_\_\_\_\_ Time \_\_\_\_\_ Stream \_\_\_\_\_ Observer \_\_\_\_\_ Survey/Casual  
 UTM-N \_\_\_\_\_ UTM-E \_\_\_\_\_ T \_\_\_\_\_ R \_\_\_\_\_ S \_\_\_\_\_ 1/4 \_\_\_\_\_

INDIVIDUALS	LEG BANDS (L top/bottom, R top/bottom)	NASAL DISCS (L:R)
1. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
2. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
3. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
4. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
5. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
6. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
7. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
8. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
9. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :
10. Sex_ Age_	/ / Legs not seen_ No bands_	_____ :

ACTIVITY	HABITAT	LOCATION	SUBSTRATE	CHANNEL TYPE
		IS island		
LO loafing	BA backwater	LO loaf	CL clay	ST straight
SW swimming	PO pool	BA bank	SA sand	ME meander
SF swim/feed	RI riffle	ED edge	GR gravel	CU curved
FL flying	GL glide	BT bank 1/3	CO cobble	BR braided
OT other	RU run	CE center	BO boulder	AB abandoned
	RA rapid	EY eddy	BE bedrock	
	PW pocketwater	PD pond		

BANK COMP.	OVERSTORY AGE	HUMAN ACCESS	DEBRIS WITHIN 10m OF DUCK
TR trees	SE seedling	AD adjacent	Loafing sites 0 1 >1
SH shrub	SA sapling	NE near	Ramp 0 1 >1
GF grass/forb	PO pole	AC accessible	Drift 0 1 >1
TS tree/shrub	IM immature	IN inaccessible	Bridge 0 1 >1
SA sand	MA mature		Collapsed br. 0 1 >1
SI silt	OG old-growth		
GR gravel			
BE bedrock			

Stream depth (m) \_\_\_\_\_ Bank undercut? Y N Stream velocity:  
 Stream width (m) \_\_\_\_\_ Overhanging vegetation? Y N \_\_\_\_\_

COMMENTS

#### STREAM HABITAT

Backwater - slow water area out of main stream channel  
Pool - deep, slow water area in the stream  
Riffle - shallow area where the surface is influenced by the stream bottom  
Glide - run area with velocity < 0.3 m/sec  
Run - deeper than a riffle, no whitewater, too fast to be a glide or a pool, velocity > 0.3 m/sec  
Rapid - whitewater, deep fast water, influenced by stream bottom and/or bank  
Pocketwater - a run or riffle with boulders (>30 cm in diameter) which create numerous small pools

#### LOCATION

Loaf - loafing on a rock or log  
Bank - on the streambank  
Edge - at the very edge of the stream next to the bank, in the bank eddy  
Bank 1/3 - beyond edge but in the third of the stream closest to the bank  
Center - in the water in the center 1/3 of the stream, not in an eddy  
Eddy - in an eddy created by a rock or a log

#### SUBSTRATE

Gravel - 0.2-7 cm (0.1-3") diameter	Boulder - >30 cm
Cobble - 8-30 cm (3-12")	Bedrock - no loose fill

#### CHANNEL TYPE

Straight - Stream channel linear, structurally controlled by a "V" shaped valley, no movement of channel during peak flows  
Meander - Channel follows sinuous curves, deep pools separated by shallow riffles, appears to shift slightly during peak flows  
Curved - Stream channel curves or zig-zags more abruptly than a meander, channel structurally controlled by a "V" shaped valley, no movement of channel during peak flows  
Braided - Channel located in flat-bottomed valley, midstream bars occur and divide the stream into several intersecting and shifting channels

#### OVERSTORY AGE

Seedling - 1-10 yrs old, < 4.5' tall	Immature - 70-100 yrs old, DBH 9-14"
Sapling - 10-40 yrs old, DBH < 5"	Mature - 100-160 yrs old, DBH 14-20"
Pole - 40-70 yrs old, DBH 5-9"	Old growth - >160 yrs old, DBH >20"

#### HUMAN ACCESS

Adjacent - established area of human activity maintained within 10m of bank  
Near - established area of human activity maintained within 10-50m of bank  
Accessible - >50 m from human activity, accessible by car or trail  
Inaccessible - >50 m from human activity, not accessible by car or trail

#### DEBRIS

Bridge - log across stream  
Collapsed bridge - log across stream, collapsed in middle of stream  
Ramp - one end of log in stream, other end on the bank  
Drift - log in stream that is not close to either bank

LOAFING SITE - rock or log in stream completely surrounded by water, suitable for resting site

VEGETATIVE OVERHANG - vegetation over the stream within 12" of water surface

**Appendix B.**

**Harlequin Streams in Montana:**

**Actual, Possible, and Potential**

**Appendix B, Table 1. Montana harlequin duck breeding and probable breeding occurrences, 1995.**

Occurrence	Status	Rank	Watershed	Primary ownership
<b>Waterton River</b> includes Kootenai Lakes Boundary Creek Olson Creek	B PRB PRB B	CB	South Saskatchewan River	GNP
<b>St. Mary River (above Lake)</b> includes St. Mary River Reynolds Creek Red Eagle Creek Rose Creek and Otokomi Lake	B PRB B B BU	CB	St. Mary River	GNP
<b>Belly River</b>	PRB	U	St. Mary River	GNP
<b>Badger Creek</b> includes North Badger Creek South Badger Creek	B B B	CB	South Marias River	LCNF
<b>Birch Creek</b> includes Birch Creek North Fork Birch Creek Middle Fork Birch Creek South Fork Birch Creek	B PRB PRB PRB B	CB	South Marias River	LCNF
<b>South Fork Two Medicine River</b> includes Summit Creek	B BU	D	South Marias River	LCNF
<b>Two Medicine River</b> includes Paradise Creek	PRB PRB	D	South Marias River	GNP, BIR
<b>North Fork Teton River</b>	B	DC	Teton River	LCNF
<b>Sun River</b> includes Sun River North Fork Sun River Biggs Creek Moose Creek South Fork Sun River Straight Creek West Fork Sun River Ahorn Creek Woods Creek	B BU B B B B B PRB BU	BA	Sun River	LCNF
<b>Boulder River</b>	B	CB	Yellowstone River	GNF
<b>Lake Fork Rock Creek</b>	PRB	DC	Clarks Fork Yellowstone	CNF

**Appendix B, Table 1, cont. Montana harlequin duck breeding and probable breeding occurrences, 1995.**

Occurrence	Status	Rank	Watershed	Primary ownership
<b>Big Creek</b>	B	D	Kootenai River	KNF
<b>Callahan Creek</b> includes Callahan Creek North Fork Callahan Creek	B BU B	D	Kootenai River	KNF
<b>Grave Creek</b>	B	C	Kootenai River	KNF
<b>Kootenai Falls</b>	H	U	Kootenai River	KNF
<b>Quartz Creek</b>	B	D	Kootenai River	KNF
<b>Wigwam River</b>	PRB	U	Kootenai River	KNF
<b>West Fork Yaak River</b>	B	DC	Yaak River	KNF
<b>Middle Fork Rock Creek</b>	B	DC	Rock Creek	DNF
<b>Big Creek</b>	PRB	D	North Fork Flathead River	FNF
<b>Upper North Fork Flathead River</b> Includes Kishenehn Creek Trail Creek	B B B	BC	North Fork Flathead River	GNP, FNF
<b>McDonald Creek</b> includes Avalanche Creek Mineral Creek Snyder Creek Sprague Creek Fish Creek Middle Fork Flathead R. (lower)	B B B PRB BU PRB B	AB	Middle Fork Flathead River	GNP, FNF
<b>Middle Fork Flathead River</b> includes Bear Creek Ole Creek	B BU BU	CD	Middle Fork Flathead River	FNF, GNP

<sup>1</sup> B = Breeding, PRB = Probable breeding, BU = Breeding status unknown.

<sup>2</sup> A = 20+ pairs within a single occurrence, B = 5 - 19 pairs within the occurrence and a minimum of 10 pairs within the occurrence and other occurrences within 40 km, C = 3+ pairs within the occurrence; if 5+ pairs then < 10 pairs within the occurrence and other occurrences within 40 km.

D = 1-2 pairs, U = Unknown. Not enough data to place in a range of 2 categories.

<sup>3</sup> CNF = National Forest, DNF = Deerlodge National Forest, FNF = Flathead National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest.

**Appendix B, Table 1, cont. Montana harlequin duck breeding and probable breeding occurrences, 1995.**

Occurrence	Status	Rank	Watershed	Primary ownership
<b>Upper South Fork Flathead River</b> includes White River Little Salmon Creek	B B B	BC	South Fork Flathead River	FNF
<b>Spotted Bear River</b>	B	CD	South Fork Flathead River	FNF
<b>Sullivan Creek</b>	B	D	South Fork Flathead River	FNF
<b>Wounded Buck Creek</b>	B	D	South Fork Flathead River	FNF
<b>Swift Creek</b>	PRB	DC	Stillwater River (north)	MTSL
<b>North Fork Blackfoot River</b> includes Dry Fork of N. Fork Blackfoot East Fork North Fork Blackfoot	B BU BU	C	Blackfoot River	LNF
<b>Rattlesnake Creek</b>	PRB	DC	Middle Clark Fork	LNF
<b>Trout Creek</b>	B	D	Middle Clark Fork	LNF
<b>Elk Creek</b>	PRB	D	Lower Clark Fork	KNF
<b>Noxon</b> includes Marten Creek South Fork Marten Creek South Branch Marten Creek McNeeley Creek Rock Creek East Fork Rock West Fork Rock Swamp Creek Vermilion River	B B BU BU B BU BU B B	BA	Lower Clark Fork	KNF

<sup>1</sup> B = Breeding, PRB = Probable breeding, BU = Breeding status unknown.

<sup>2</sup> A = 20+ pairs within a single occurrence, B = 5 - 19 pairs within the occurrence and a minimum of 10 pairs within the occurrence and other occurrences within 40 km, C = 3+ pairs within the occurrence; if 5+ pairs then <10 pairs within the occurrence and other occurrences within 40 km.

D = 1-2 pairs, U = Unknown. Not enough data to place in a range of 2 categories.

<sup>3</sup> FNF = Flathead National Forest, MTS = Montana Dept. of State Lands, KNF = Kootenai National Forest, LNF = Lolo National Forest.

**Appendix B, Table 2. Montana streams where harlequin ducks have been observed or reported, but current breeding status is unknown.**

Stream	Watershed	Primary ownership <sup>1</sup>	No. surveys conducted
<b>Otatso Creek</b> includes Slide Lake	St. Mary River	GNP	0
<b>Cut Bank Creek</b>	Cut Bank Creek	BIR	0
<b>South Fork Teton River</b>	Teton River	LCNF	3
<b>Upper Madison River</b>	Madison River	GNF	0
<b>Elk Creek</b> includes East Fork Elk Creek West Fork Elk Creek	Upper Yellowstone River	GNF	1
<b>Mill Creek</b>	Upper Yellowstone River	GNF	1
<b>Sweet Grass Creek</b>	Upper Yellowstone River	GNF	0
<b>Rock Creek</b> includes West Fork Rock Creek	Clarks Forks Yellowstone	CNF	0
<b>West Fork Stillwater</b>	Stillwater River (south)	CNF	1
<b>Lake Creek</b>	Kootenai River	KNF	1
<b>Seventeenmile Creek</b>	Yaak River	KNF	5
<b>Clearwater River</b>	Blackfoot River	LNF	0
<b>Willow Creek</b>	Blackfoot River	HNF	0
<b>Cache Creek</b>	Middle Clark Fork	LNF	0
<b>Twelvemile Creek</b>	Middle Clark Fork	LNF	2
<b>North Fork Flathead River</b> (south of Trail Creek)	North Fork Flathead River	GNP, FNF	5
<b>Red Meadow Creek</b>	North Fork Flathead River	FNF	3
<b>Whale Creek</b>	North Fork Flathead River	FNF	5

<sup>1</sup> BIR = Blackfeet Indian Reservation, BNF = Bitterroot National Forest, CNF = Custer National Forest, FNF = Flathead National Forest, GNF = Gallatin National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest, LCNF = Lewis Clark National Forest, LNF = Lolo National Forest.

**Appendix B, Table 2 cont. Montana streams where harlequin ducks have been observed or reported, but current breeding status is unknown.**

Stream	Watershed	Primary ownership <sup>1</sup>	No. surveys conducted
<b>Starvation Creek</b>	North Fork Flathead River	GNP	0
<b>Middle Fork Flathead River</b> sections between and above known sites	Middle Fork Flathead River	GNP, FNF	3
<b>Granite Creek</b>	Middle Fork Flathead River	FNF	0
<b>Lincoln Creek</b>	Middle Fork Flathead River	GNP	1
<b>Nyack Creek</b>	Middle Fork Flathead River	GNP	0
<b>Bunker Creek</b>	South Fork Flathead River	FNF	5
<b>South Fork Flathead River</b> includes sections above reservoir not included in Appendix B, Table 1.	South Fork Flathead River	FNF	5
<b>Jocko River</b>	Lower Flathead River	FIR	0
<b>Stillwater River</b>	Stillwater River (northern)	MDSL KNF	4
<b>Bull River</b> upper stretches of major forks	Lower Clark Fork	KNF	1-3
<b>Deep Creek</b>	Lower Clark Fork	LNF	0
<b>Fishtrap Creek</b>	Lower Clark Fork	LNF	5
<b>Graves Creek</b>	Lower Clark Fork	LNF	9
<b>White Pine Creek</b>	Lower Clark Fork	KNF	1

<sup>1</sup> BIR = Blackfeet Indian Reservation, BNF = Bitterroot National Forest, CNF = Custer National Forest, FNF = Flathead National Forest, GNF= Gallatin National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest, LCNF = Lewis Clark National Forest, LNF = Lolo National Forest.

Appendix B. Table 3. Partial list of potential harlequin duck breeding streams in Montana.

Stream	Watershed	Primary ownership <sup>1</sup>	No. surveys conducted
Sherburne River	St. Mary River	GNP	0
Middle Fork Teton River	Teton River	LCNF	0
Pattengail Creek	Wise River	BNF	0
West Fork Madison River	Madison River	GNF	1
Taylor Fork Gallatin River	Gallatin River	GNF	1
Upper Boulder River	Boulder River	DNF	0
Milk River (upper forks)	Milk River	BIR	0
West Fork Teton River	Teton River	LCNF	1
Dearborn River (& forks)	Dearborn/Missouri Rivers	LCNF	3
Forks of Boulder River	Upper Yellowstone River	GNF	2-4
Hellroaring Creek	Upper Yellowstone River	GNF	0
Slough Creek	Upper Yellowstone River	GNF	0
Big Creek	Upper Yellowstone River	GNF	1
Rock Creek	Upper Yellowstone River	GNF	0
Rosebud Creek	Stillwater River (south)	CNF	2
Stillwater River (& forks)	Stillwater River (south)	CNF	4
South Fork Callahan Creek	Kootenai River	KNF	4
Keeler Creek	Kootenai River	KNF	2
Fish Creek (& forks)	Middle Clark Fork River	LNF	0
Anaconda Creek	North Fork Flathead River	GNP	0
Bowman Creek	North Fork Flathead River	GNP	1
Camas Creek	North Fork Flathead River	GNP	0
Kintla Creek	North Fork Flathead River	GNP	2

<sup>1</sup> BIR = Blackfeet Indian Reservation, BNF = Bitterroot National Forest, CNF = Custer National Forest, FNF = Flathead National Forest, GNF= Gallatin National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest, LCNF = Lewis Clark National Forest, LNF = Lolo National Forest.

**Appendix B. Table 3, cont. Partial list of potential harlequin duck breeding streams in Montana.**

Stream	Watershed	Primary ownership <sup>1</sup>	No. surveys conducted
Quartz Creek	North Fork Flathead River	GNP	0
Coal Creek	Middle Fork Flathead River	GNP	0
Dolly Varden Creek	Middle Fork Flathead River	FNF	2
Morrison Creek	Middle Fork Flathead River	FNF	1
Park Creek	Middle Fork Flathead River	GNP	0
Schafer Creek	Middle Fork Flathead River	FNF	2
Bunker Creek	South Fork Flathead River	FNF	5
Trout Creek	Lower Clark Fork River	KNF	3

<sup>1</sup> FNF = Flathead National Forest, GNP = Glacier National Park, KNF = Kootenai National Forest.

## **Appendix C.**

### **Montana Harlequin Duck surveys: 1995**

Appendix C. Montana Harlequin Duck surveys 1995.

Drainage:	Hydrologic Code	Stream	Upper end	Lower end	Date	kms	M	F	J	U	Pr	Source Code
<b>UPPER YELLOWSTONE RIVER DRAINAGE: 100700</b>												
Stillwater River Drainage:	10070005	Rosebud Creek, West	T07S R16E S01 NW	T05S R17E S35 SW	7-8 Aug 1995	24						Reichel and Genter 1996
		Rosebud Creek, West	T07S R17E S16 SW	T07S R17E S02 SE	8 Aug 1995	9						Reichel and Genter 1996
Clark's Fork of the Yellowstone River Drainage:	10070006	Rock Creek (tributaries covered separately)	T09S R19E S25 NW	T08S R19E S36 SW	11 Aug 1995	22						Reichel and Genter 1996
		Rock Creek, Lake Fork	T08S R18E S32	T08S R19E S34 SW	10 Aug 1995	19						Reichel and Genter 1996
		Rock Creek, West Fork	T07S R18E S34 SW	T08S R19E S11 NE	9 Aug 1995	21						Reichel and Genter 1996
<b>KOOTENAI RIVER DRAINAGE: 170101</b>												
Upper Kootenai River Drainage:	17010101	Big Creek	T34N R30W S20	T34N R29W S3	7 May 1994	18						Reichel and Genter 1996
		Callahan Creek	T31N R34W S20NE	30 Apr 1995	4							Reichel and Genter 1996
		confluence forks	Troy	12 May 1995	14							Reichel and Genter 1996
		confluence forks	Troy	10 Jul 1995	14							Reichel and Genter 1996
		S Fork	T59N R35W S26 SW	confluence forks	12 May 1995	5						Reichel and Genter 1996
		N Fork	564300E 536800N	confluence forks	30 Apr 1995	11	1					Reichel and Genter 1996
			T59N R03E S21 NW	confluence forks	9 Jul 1995	10						Reichel and Genter 1996
		Grave Creek	T37N R24W S32 SW	T36N R25W S12 SW	1 May 1995	6						Reichel and Genter 1996
			T36N R25W S12 SW	T35N R26W S12 NE	1 May 1995	14						Reichel and Genter 1996
			T36N R25W S01 NE	T35N R26W S12 NE	31 Jul 1995	18						Reichel and Genter 1996
		Keeler Creek	T30N R34W S30 SE	T30N R34W S27 NW	11 May 1995	6						Reichel and Genter 1996
		Kootenai River (tributaries covered separately)	Kootenai Falls	T31N R33W S13 NW	11 May 1995	0.5						Reichel and Genter 1996
				T31N R33W S13 NW	17 Jul 1995	1						Reichel and Genter 1996
		Libby Creek	T31N R33W S13 NE									
		Quartz Creek	T28N R31W S25 SE	T28N R30W S04 NW	17 Jul 1995	16						Reichel and Genter 1996
			T31N R32W S2 SE	T31N T32W S24 NW	30 Apr 1995	6						Reichel and Genter 1996

**Appendix C (cont.). Montana Harlequin Duck surveys 1995.**

Drainage: Hydrologic Code		Upper end	Lower end	Date	kms	M	F	J	U	P <small>r</small>	Source Code
<b>Fisher River Drainage: 17010102</b>											
West Fisher River	T54N R30W S03 SW		T27N R29W S31 N	17 Jul 1995	10						Reichel and Genter 1996
Seventeenmile Creek	T33N R32W S10 SE	T34N R33W S27 SE		19-20 Jul 1995	16						Reichel and Genter 1996
Spread Creek	T36N R33W S30 NE	T35N R33W S03 S	19 Jul 1995	9							Reichel and Genter 1996
Yaak River, North Fork (tributaries covered separately)	T37N R31W S10 NW	T37N R31W S23 NW	18 Jul 1995	5							Reichel and Genter 1996
Yaak River, West Fork	T37N R32W S15 SE	T37N R31W S32 NW	18 Jul 1995	13	1	2					Reichel and Genter 1996
<b>CLARK FORK RIVER DRAINAGE: 170102</b>											
<b>Blackfoot River Drainage: 17010203</b>											
Blackfoot River, Lander's Fork	T16N,R08W,S07 SSW	T14N,R08W,S12		25 May 1995	26						Reichel and Genter 1996
Blackfoot River, North Fork	T17N R10W S15 NENW	T17N R10W S29 SE	26 May 1995	5							Reichel and Genter 1996
	T17N R10W S2 NE	T17N R10W S15 NEW	28 May 1995	6							Reichel and Genter 1996
North Fork Blackfoot River, Dry Fork	T17N R11W S13 NW	T17 R10W S31 NE	29 May 1995	8							Reichel and Genter 1996
North Fork Blackfoot River, East Fork	T16N R09W S07 NW	T17 R10W S28 SW	27 May 1995	14							Reichel and Genter 1996
Copper Creek	T15N R08W S05 NW	T15N R08W S36 SENW	24 May 1995	16							Reichel and Genter 1996
Middle Clark Fork River Drainage: 17010204											Reichel and Genter 1996
Trout Creek	T15N R26W S18 SW	T16N R26W S14 SW	12 Jul 1995	19							Reichel and Genter 1996
<b>North Fork Flathead River: 17010206</b>											
Trail Creek	T37N,R23W,S25 SESW	T37N,R22W,S35 SESE	8 May 1995	15		2					Reichel and Genter 1996
	T37N,R23W,S25 NWSE	T37N,R22W,S35 SESE	30 Jul 1995	14							Reichel and Genter 1996
Whale Creek	T36N,R22W,S20 SE	T36N,R21W,S30 SW	98 May 1995	10							Reichel and Genter 1996

Appendix C (cont.). Montana Harlequin Duck surveys 1995.

Drainage: Hydrologic Code	Stream	Upper end	Lower end	Date	kms	H	F	J	U	Pr	Source Code
<b>South Fork Flathead River Drainage: 17010209</b>											
Spotted Bear River	T25N, R13W, S7 SW	T25N, R15W, S17 SW	17 May 1995	19	1						Reichel and Genter 1996
	T25N, R13W, S16 NW	T25N, R13W, S08 SE	1 Aug 1995	3							Reichel and Genter 1996
	T25N, R13W, S08 SE	T25N, R15W, S17 SW	2 Aug 1995	20							Reichel and Genter 1996
Sullivan Creek	T26N, R16W, S31 NE	T26N, R17W, S1 NENE	16 May 1995	13	1					1	Reichel and Genter 1996
	T26N, R16W, S31 NE	T26N, R17W, S1 NENE	1 Aug 1995	13	1						Reichel and Genter 1996
<b>Stillwater River Drainage: 17010210</b>											
Stillwater River	T34N R24W S05 SW	T34N R25W S25 SE	5 Jul 1995	16							Reichel and Genter 1996
Swift Creek	T33N R23W S24 SW	T32N R22W S30 SE	31 May 1995	15	2						Reichel and Genter 1996
	T33N R23W S24 SW	T31N R22W S05 NW	6 Jul 1995	20							Reichel and Genter 1996
<b>Lower Clark Fork River Drainage: 17010213</b>											
Marten Creek	T25N, R32W, S32	T25N, R33W, S32	26 Apr 1995	16	2					3	Reichel and Genter 1996
	T25N, R33W, S28	T25N, R32W, S31	10 Jul 1995	10							Reichel and Genter 1996
	T25N R33W S26	T25N R32W S32	29 July 1994	6							Reichel and Genter 1996
North Branch Marten Creek	T25N, R32W, S32	T25N, R32W, S32	26 Apr 1995	0.5							Reichel and Genter 1996
South Branch Marten Creek	T25N, R32W, S32	T25N, R32W, S32	26 Apr 1995	1							Reichel and Genter 1996
South Fork Marten Creek	T24N, R33W, S31 NE	T25N, R32W, S31	27 Apr 1995	4	1					5	Reichel and Genter 1996
	T24N, R33W, S11 SW	T25N, R32W, S31	10 Jul 1995	4							Reichel and Genter 1996
	T24N, R33W, S11 SW	T25N, R32W, S31	29 Jul 1995	4							Reichel and Genter 1996
Rock Creek	T26N R32W S28	T26N R32W S2	28 Apr 1995	12	2						Reichel and Genter 1996
	T26N R32W S28	T26N R32W S2	26 July 1995	10							Reichel and Genter 1996
Swamp Creek	T26N, R31W, S27 SE	T25N, R31W, S20 NW	29 Apr 1995	10	1					3	Reichel and Genter 1996
	T26N, R31W, S34 SE	T25N, R31W, S20 NW	27 Jul 1995	8							Reichel and Genter 1996
Trout Creek	East Fork	Reservoir	28 Apr 1995	16							Reichel and Genter 1996
Vermilion River	T25N R29W S33	T24N R31W S14	27 Apr 1995	18	3						Reichel and Genter 1996
	T25N R29W S33	T24N R31W S14	11-12 July 1995	18							Reichel and Genter 1996
	T25N R29W S33	T24N R31W S14	29 July 1995	18	2						Reichel and Genter 1996
* a female with a brood of 6 from Marten Creek was also seen											

## **Appendix D.**

### **List of Harlequin Ducks observed on surveys in 1995**

List of Harlequin Ducks observed or marked in 1995 on surveys.

	utm zone	N-utm	E-utm	Da	Mo	Year	Surv	M	F	J	U	Observer	Comments
<b>KOOTENAI RIVER DRAINAGE: 170101</b>													
<b>Upper Kootenai River Drainage: 170101</b>													
Callahan Creek	11	5365000	571000	30	4	1995	Yes	1				CDC	
	11	5365620	570000	9	7	1995	Yes	1				CDC	
Grave Creek	11	5416000	660900	2	5	1995	Yes	1	1			JDR	
	11	5414800	660500	2	5	1995	Yes	1	1			RF	
	11	5411270	658700	2	5	1995	Yes	1	1			RF	
	11	5409550	657250	2	5	1995	Yes	1	1			CDC	
	11	5413580	659720	31	7	1995	Yes	1	1			2 CDC	
	11	5417210	661430	31	7	1995	Yes	1	4			CDC	
	11	5417130	661340	31	7	1995	Yes	1	4			DPH, R Kerr	
<b>Yaak River Drainage: 170103</b>													
Yaak River, West Fork (tributaries covered separately)													
	11	5420900	592950	18	7	1995	Yes	1	2			CDC	
													1 brood, Class IIIB
<b>CLARK FORK RIVER DRAINAGE: 170102</b>													
<b>Blackfoot River Drainage: 17010203</b>													
Blackfoot River, East Fork of the North Fork (tributaries covered separately)													
	12	5228280	357400	27	5	1995	Yes	1	1			CDC	
Blackfoot River, North Fork (tributaries covered separately)													
	12	5230700	358690	26	5	1995	Yes	1	1			CDC	
	12	5231620	358820	28	5	1995	Yes	1	1			CDC	
	12	5223930	358820	28	5	1995	Yes	1	1			CDC	
	12	5234110	360480	28	5	1995	Yes	1	1			CDC	
<b>North Fork Flathead River Drainage: 17010206</b>													
Trail Creek													
	11	5423400	681290	8	5	1995	Yes	1	1			CDC	
	11	5423730	682200	8	5	1995	Yes	1	1			CDC	
													pair
													pair

List of Harlequin Ducks observed or marked in 1995 on surveys.

utm zone	N-utm	E-utm	Da	Mo	Year	single			Comments	
						Surv	M	F	J	
11	5423850	683200	8	5	1995	Yes	1	1	CDC	pair
11	5423800	683400	8	5	1995	Yes	1	1	CDC	pair
11	5423520	683800	8	5	1995	Yes	1	1	CDC	pair
11	5423300	684100	8	5	1995	Yes	2		CDC	
11	5423220	685100	8	5	1995	Yes	1	1	CDC	pair
<b>South Fork Flathead River Drainage: 17010209</b>										
Spotted Bear River										
12	5312620	315430	17	5	1995	Yes	1		CDC	
12	5310650	327900	2	8	1995	Yes	1	5	CDC	1 brood
12	5310550	323590	2	8	1995	Yes	1		CDC	
Sullivan Creek										
12	5318670	298900	16	5	1995	Yes	1		CDC	
12	5319060	298860	16	5	1995	Yes	1		CDC	
12	5324600	299600	16	5	1995	Yes	1	1	CDC	pair
12	5321780	298000	1	8	1995	Yes	1		CDC	
<b>Stillwater River Drainage: 17010210</b>										
Swift Creek										
11	5378500	687200	31	5	1995	Yes	1		CDC	
11	5377250	688000	31	5	1995	Yes	1		CDC	
<b>Lower Clark Fork River Drainage: 17010213</b>										
Marten Creek										
11	5304780	589150	26	4	1995	Yes	1	1	CDC, DPH,R Fawcett, Jill, Rod, JDR pair	
11	5304820	587570	26	4	1995	Yes	1	3	CDC, DPH,R Fawcett, Jill, Rod, JDR pair + 2 males	
11	5304300	585550	26	4	1995	Yes	1	1	CDC, DPH,R Fawcett, Jill, Rod, JDR pair	
11	5304700	598950	11	7	1995	Yes	2		CDC	
11	5304370	586450	11	7	1995	Yes	1		CDC	
11	5303200	592950	28	7	1995	Yes		5	JDR	Class III
11	5303100	592670	28	7	1995	Yes	1	6	JDR	1 brood, Class IV
11	5303400	593100	27	7	1995	No	1	6	JDR	1 brood, Class IV
Marten Creek, South Fork										

List of Harlequin Ducks observed or marked in 1995 on surveys.

utm zone	N-utm	E-utm	Da	Mo	Year	Surv	single			Comments
							M	F	J	
11	5302040	590500	27	4	1995	Yes	1			Class IB
	11	5301680	593570	10	7	1995	Yes	5		
Rock Creek	11	5314420	595420	26	7	1995	Yes	1	5	DPH,CDC
	11	5317820	596850	28	4	1995	Yes	2		DPH,R Fawcett
Swamp Creek	11	5309750	604490	29	4	1995	Yes	1	1	pair
	11	5310850	605000	29	4	1995	Yes	1		
11	5312300	605340	29	4	1995	Yes	1		DPH	pair
	11	5311780	605200	29	4	1995	Yes	1	1	R Fawcett
11	5312800	605730	27	7	1995	Yes	1	1		pair
	11	5312960	605800	27	7	1995	Yes	1	6	R Fawcett
Vermilion River	11	5302800	620650	27	4	1995	Yes	1	4	CDC
	11	5302770	620000	27	4	1995	Yes	2		CDC
11	5302830	619500	11	7	1995	Yes	1	6	CDC	1 brood, Class IB
	11	5302800	619000	11	7	1995	Yes	1	5	CDC
11	5301760	615300	11	7	1995	Yes	1		CDC	1 brood, Class IA
	11	5302750	619650	29	7	1995	Yes	1	6	CDC
11	5302593	617529	29	7	1995	Yes	1	3	CDC	1 brood (flying) also seen and marked previous day on Marten Cree
	11	5300820	611860	29	7	1995	Yes	1	2	CDC
										1 brood Class IIIB
										1 brood Class IIB
										1 brood Class IB

## **Appendix E.**

### **Miscellaneous reports of Harlequin Ducks during 1995**

Appendix E. Miscellaneous reports of Harlequin Ducks in Montana during 1995 and reports for prior years received during 1994.

Stream & Location	Date	Harlequins						Observer
		M	F	J	U	Pr	Br	
<b>Glacier National Park</b> McDonald Creek, 2 mi above Lake McDonald	28 May 1995							2 Thomas Johannesmeyer
<b>Kootenai National Forest</b> Grave Creek, 30 m above Lewis Creek bridge T36N R25W S29 [NOTE: section 29 is not on the creek]	26 May 1990							1 Gene & Betty Holder
0.1 mi above Blue Sky bridge	1 Aug 1991							5 Kevin Ruble
0.1 mi above Blue Sky bridge	May 1994	1	1					Lynn Johnson
0.1 mi above Blue Sky bridge	June 1994		1					Lynn Johnson (bird banded)
0.1 mi above Blue Sky bridge	24 May 1995							Lynn Johnson
at bridge over Lewis Creek	24 May 1995		1					Lynn Johnson
just downstream of Stoken bridge T35N R26W S12 NE ¼	27 May 1995		1					Raven Stevens
0.1 mi above Blue Sky bridge	11 June 1995		1					Lynn Johnson (bird banded)
Kootenai River, 3/4 mi below dam	22 June 1995		1					Jean Habbeck
<b>Custer National Forest</b> Rock Creek, Lake Fork, about 5 mi up at second bridge Black Canyon Creek	5 June 1995							1 Babbitt at , confluence with
near Lost Lake area	2-4 July 1995		1					via Lynn at Beartooth R.D.
near Broadwater Lake	17 June 1995	1	2					Liz Sorenson via Beartooth RD.
in Lost Lake	18 June 1995	1						Rachel Jam via Beartooth R. D.
at Keyser Brown	1 July 1995							Judy McNally
in Lost Lake	1 July 1995		1					Susan Nichols
near Beartooth Pond	3 July 1995							Eddie Eckley
confluence with Black Canyon Creek	21 July 1995		1					Doug
Rock Creek, West fork, below Sentinel Falls	2-4 July 1995		1					via Lynn at Beartooth R. D.
	30 June 1995						2	Roy Butler
<b>Deerlodge National Forest</b> Rock Creek, Middle Fork	18 July 1995		1	1				1 K. Forkan & M. Fink
<b>Flathead National Forest</b> Flathead River, North Fork, T36N R21W S31 NE ¼	6 Aug 1995							Nancy Warren
Stillwater River, T34N R24W S30	4 May 1991		1	1				Lynn Johnson

**Appendix E. Miscellaneous reports of Harlequin Ducks in Montana during 1995 and reports for prior years received during 1994.**

Stream & Location	Date	Harlequins					Observer
		M	F	J	U	Pr	
<b>Gallatin National Forest</b>							
Boulder River, T6S R12E S21	1 May 1995					1	Jim Sparks
head of Hells Canyon	6 May 1995					1	Brad Stewart
T6S R12E S3	23 May 1995	1					Jim Sparks
T6S R12E S21	30 May 1995				3		Jim Sparks
lower fourmile Campgrounds	3 June 1995			1			Jim Sparks
lower fourmile Campgrounds	4 June 1995				1		Jim Sparks
confluence with Clear Creek (T6S R12E S16)	4 June 1995				1		Jim Sparks
confluence with Clear Creek (T6S R12E S16)	7 June 1995				1		Jim Sparks
confluence with Bridge Creek (T6S R12E S21)	7 June 1995				1		Jim Sparks
at Hillary Bridge (T6S R12E S4)	7 June 1995				1		Jim Sparks
above Hillary Bridge	11 June 1995				1		Jim Sparks
lower fourmile Campgrounds	11 June 1995						Jim Sparks
lower fourmile Campgrounds	24 June 1995	2					Jim Sparks
below Bridge Creek [T6S R12E S21]	18 July 1995		1				Jim Sparks
below Bridge Creek [T6S R12E S21]	23 July 1995		4	14(6,6,2)		3	Jim Sparks
Hicks Park	25 July 1995		3	15(6,6,2,1)		4	Jim Sparks
at confluence with Bridge Creek	27 July 1995		1	8		1	Jim Sparks
Clear Creek Park	14 Aug 1995		1	6		1	Jim Sparks
Hicks Park	25 Aug 1995		1	7		1	Jim Sparks
Boulder River, East Fork, above Box Canyon [T6S R12E S33]	11 June 1995		1	4		1	Jim Sparks
Lake Kathleer T7S R12E S11	30 June 1995		1				Jim Sparks
<b>Lewis and Clark National Forest</b>							
Badger Creek, North, T29N R12W S22	14 May 1995			1	1		S. Tomson
T29N R12W S25	15 May 1995			1	1		S. Tomson
T29N R12W S25	14 May 1995			1	1		Maples
T29N R12W S33	14 May 1995			1	1		Maples
T28N R12W S4	14 May 1995			1	1		Maples
Birch Creek, Swift Reservoir	11 May 1995			1	1		Pat Finnegan
Swift Reservoir	11 May 1995			1	1		Pat Finnegan
Swift Reservoir	11 May 1995			4	3		Pat Finnegan
Birch Creek, South Fork, utm 5330500 358900	11 May 1995			1	1		Pat Finnegan
utm 5331400 358300	11 May 1995			1	1		Pat Finnegan

**Appendix E. Miscellaneous reports of Harlequin Ducks in Montana during 1995 and reports for prior years received during 1994.**

Stream & Location	Date	Harlequins					Observer
		M	F	J	U	Pr	
utm 5327700 359600	11 May 1995	2	2				Pat Finnegan
Sun River, South Fork T27N R10W S4	21 July 1995		3				Joe Woodhead
T21N R10W S19	30 May 1995	1	1				B. Flesch
confluence w/ North Fork	27 May 1995			1			Brad McBratney
T20N R10W S8	28 May 1995				1		Ray Mills
confluence w/ North Fork	10 May 1995	1					Mike Marsh
confluence w/ Burnt Creek	13 June 1995		1				Mike Marsh
100 m E of confluence w/ Deer Creek	24 July 1995		1				Mike Marsh
E of confluence w/ Deer Creek	18 July 1995		2	5			Mike Marsh
up S. Fork 2 mi toward Hoadly Creek	25 July 1995		1	4			Mike Marsh
1 mi W of Big Head Treail	7 Aug 1995		1	5			Mike Marsh
1 mi E of West Fork confluence	9 Aug 1995		1	5			Mike Marsh
Pretty Prairie Area	29 July 1995		1	4			Mike Marsh
T22N R10W S27	28 May 1995	8	3				Robert Willits
T22N R10W S27	27 May 1995	1					Bill Hill
T22N R10W S26	18 July 1995		1	2			Bill Hill
Sun River, West Fork of South Fork T22N R12W S24	14 June 1995		2	2			Bill Hill
Two Medicine, T30N R13W S28	7 July 1995		2				R. Mills
	12 May 1995		2				R. Fergus
Lolo National Forest	5 June 1995					1	William Deibert
Cache Creek, 5 mi up trail #317T						1	Dan Browder
Blackfoot River, North Fork, 1/8 mi upstream from Broadus Creek	25 May 1995						
<b>Miscellaneous</b>							
Marias River, Lat: 48° 15' 30", Long: 110° 51' 10"	2 Sept 1995					1	C. Paige
Boulder River, at Bernice Ponds, Jefferson Co.	25 June 1994						Sally Sovey
<b>BRITISH COLUMBIA</b>							
Flathead River, North Fork, about 5 mi N of U.S. border	13 July 1995				1		via Betty Kuropat
Wigwam River (first 10 mi. above border)	24 June 1994				6		John Gangemi

## **Appendix F.**

### **Harlequin Duck numbers in each occurrence for Montana**

**Appendix F. Montana harlequin duck numbers in each occurrence.**

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year <sup>1</sup>	Correction Factor	Estimated # of pairs present <sup>2</sup>	
<b>Waterton River</b>					14
includes Waterton River/Kootenai Lakes	8	8	.72	11	
Boundary Creek	-	1	.72	1	
Olson Creek	-	1	.72	1	
<b>St. Mary River (above Lake)</b>					8
includes St. Mary River	3	3	.72	4	
Reynolds Creek	1	2	.72	3	
Red Eagle Creek		1	.72	1	
Rose Creek and Otokomi Lake	0	0	.72	0	
<b>Belly River</b>		1	.72	1	1
<b>Badger Creek</b>					17
includes Badger Creek	3	3	.72	4	
North Badger Creek	6	6	.72	8	
South Badger Creek	3	3	.72	4	
<b>Birch Creek</b>					6
includes Birch Creek	0	0	.72	0	
North Fork Birch Creek	1	1	.72	1	
Middle Fork Birch Creek	1	1	.72	1	
South Fork Birch Creek	2	2	.72	3	
<b>South Fork Two Medicine River</b>					1
includes S. Fork Two Medicine River	1	1	.72	1	
Summit Creek	0	0	.72	0	
<b>Two Medicine River</b>					1
includes Two Medicine River	0	0	.72	0	
Paradise Creek	1	1	.72	1	

<sup>1</sup> The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

<sup>2</sup> Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

**Appendix F. Montana harlequin duck numbers in each occurrence.**

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year <sup>1</sup>	Correction Factor	Estimated # of pairs present <sup>2</sup>
<b>North Fork Teton River</b>	1	1	.72	1
<b>Sun River</b>				24
includes Sun River	0	0	.72	0
North Fork Sun River	2	2	.72	3
Moose Creek	1	1	.72	1
South Fork Sun River	6	6	.72	8
Straight Creek	2	2	.72	3
West Fork Sun River	4	4	.72	6
Ahorn Creek	1	1	.72	1
Woods Creek	1	1	.72	1
<b>Boulder River</b>	4	4	.72	6
<b>Lake Fork Rock Creek</b>	2	2	.72	3
<b>Big Creek (Koocanusa)</b>	0	0	.72	0
<b>Callahan Creek</b>				3
includes Callahan Creek	1	1	.72	1
North Fork Callahan Creek	1	1	.72	1
<b>Grave Creek</b>	5	5	.72	7
<b>Kootenai Falls</b>	0	0	.72	0
<b>Quartz Creek</b>	0	0	.72	0
<b>Wigwam River</b>	0	0	.72	0
<b>West Fork Yaak River</b>	1	1	.72	1
<b>Middle Fork Rock Creek</b>	0	1	.72	1
<b>Big Creek (N.F. Flathead)</b>	1	1	.72	1

<sup>1</sup> The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

<sup>2</sup> Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

**Appendix F. Montana harlequin duck numbers in each occurrence.**

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year <sup>1</sup>	Correction Factor	Estimated # of pairs present <sup>2</sup>
<b>Upper North Fork Flathead River</b>				8
Includes Kishenehn Creek	0	1	.72	1
Trail Creek	6	6	.90	7
<b>McDonald Creek</b>				41
includes McDonald Creek to Logan Ck	14	21	.90	23
McDonald Ck above Logan Ck	3	3	.72	4
Avalanche Creek	2	2	.72	3
Mineral Creek	1	1	.72	1
Snyder Creek	2	2	.72	3
Sprague Creek	2	2	.72	3
Fish Creek	2	2	.72	3
Middle Fork Flathead R. (lower)	0	1	.72	1
<b>Middle Fork Flathead River</b>				3
includes Bear Creek	0	1	.72	1
Ole Creek	0	1	.72	1
<b>Upper South Fork Flathead River</b>				14
includes Upper S. F. Flathead	4	4	.72	6
White River	4	4	.72	6
Little Salmon Creek	2	2	.72	3
<b>Spotted Bear River</b>	3	3	.72	4
<b>Sullivan Creek</b>	2	2	.72	3
<b>Wounded Buck Creek</b>	1	1	.72	1
<b>Swift Creek</b>	1	1	.72	1

<sup>1</sup> The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

<sup>2</sup> Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

**Appendix F. Montana harlequin duck numbers in each occurrence.**

Occurrence	Maximum # pairs/females seen on a single survey	Minimum # of pairs present in max. year <sup>1</sup>	Correction Factor	Estimated # of pairs present <sup>2</sup>
<b>North Fork Blackfoot River</b>				8
includes North Fork Blackfoot	4	4	.72	6
Dry Fork of N. F. Blackfoot	0	1	.72	1
E. Fork North Fork Blackfoot	1	1	.72	1
<b>Rattlesnake Creek</b>	0	0	.72	0
<b>Trout Creek</b>	2	0	.72	0
<b>Elk Creek</b>	0	1	.72	1
<b>Noxon</b>				17
includes Marten Creek	5	5	.90	6
Rock Creek	3	4	.90	4
Swamp Creek	3	3	.90	3
Vermilion River	3	3	.90	3
<b>TOTAL</b>		151		198

<sup>1</sup> The least number of pairs present in the year with the highest survey number, except when the occurrence is believed to be extirpated; then the number is 0.

<sup>2</sup> Total estimated pairs in multi-stream occurrences may not equal the sum of the streams because, while the numbers are shown as integers, the exact numbers are used in calculations.

**Appendix G.**

**Streams surveyed for Harlequin Ducks  
in Montana during 1987-94**

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM zon N/S utm	E/W utm zon N/S utm	Lower UTM E/W utm	N/S utm	Mo	Year	Type seen	#	Source	Comments
<b>SASKATCHEWAN RIVER DRAINAGE: 100100100</b>										
<b>South Saskatchewan River Drainage: 1001001</b>										
Boundary Creek										
12 5431060	282040	12	5430890	287630	22	8	1993	walk		Ashley 1994b
Olson Creek										
12 5425160	284870	12	5426260	287670	21	8	1993	walk		Ashley 1994b
11 5425610	717970	11	5425690	718120	21	8	1993	walk		Ashley 1994b
11 5424920	719390	12	5224800	280800	21	8	1993	walk		Ashley 1994b
12 5425240	284140	12	5425160	284870	21	8	1993	walk		Ashley 1994b
Waterton River (tributaries covered separately)										
12 5419870	287080	12	5426700	288300	20	8	1993	walk		Ashley 1994b
12 5422730	286830	12	5423140	287500	20	8	1993	walk		Ashley 1994a
12 5423140	287500	12	5426700	288300	22	9	1994	walk	2	Ashley 1994a

**St. Mary River Drainage: 10010002**

Red Eagle Creek										
12 5392160	315740	12	5397370	317760	19	8	1993	walk		Ashley 1994b
12 5391230	315180	12	5392160	315740	19	8	1993	walk		Ashley 1994b
Reynolds Creek										
12 5393540	305890	12	5392530	306490	30	6	1993	walk	1	Ashley 1994b
12 5394810	303370	12	5392530	306490	13	8	1993	walk	9	Ashley 1994b
12 5395640	302610	12	5393530	306490	26	5	1994	walk	2	Ashley 1994a
12 5393540	305890	12	5393530	306490	4	9	1994	walk		Ashley 1994a
St. Mary River (tributaries covered separately)										
12 5393530	306490	12	5393820	308290	30	6	1993	walk	1	Ashley 1994b
12 5391740	303250	12	5393820	308290	13	8	1993	walk	1	Ashley 1994b
12 5393530	306490	12	5393820	308290	4	9	1994	walk		Ashley 1994a

**MISSOURI RIVER HEADWATERS DRAINAGE: 100200**

Madison River Drainage: 10020007										
Beaver Creek										
12 4974580	471330	12	4977650	471600	21	6	1990			Markum 1990
12 4974580	471330	12	4977650	471600	8	8	1990			Markum 1990
Cabin Creek										
12 4970080	474230	12	4968280	472870	21	6	1990			Markum 1990
12 4970080	474230	12	4968280	472870	8	8	1990			Markum 1990
Grayling Creek										

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydologic Code**

Stream	Upper UTM			Lower UTM			#	Source	Comments
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm			
12 4960080	489580	12	4960250	491410	22	6	1990	Markum	1990
12 4960080	489580	12	4960250	491410	9	8	1990	Markum	1990
Madison River, West Fork									
12 4966850	472450	12	4967750	473400	8	8	1990	Markum	1990

**Gallatin River Drainage: 10020008**

Gallatin River (tributaries covered separately)									
12 5028060	482360	12	5033630	480750	23	5	1990	Markum	1990
12 5013050	481190	12	5033630	480750	27	7	1990	Markum	1990
12 5023330	486300	12	5013050	481190	30	7	1990	Markum	1990
12 5012240	480320	12	5018000	485490	1	8	1990	Markum	1990
12 4991280	484180	12	5012240	480320	1	8	1990	Markum	1990
Hyalite Creek									
12 5039370	500180	12	5041240	499080	16	6	1990	Markum	1990
12 5036870	501770	12	5039370	500180	19	6	1990	Markum	1990
Squaw Creek									
12 5030680	487780	12	5031230	486810	23	5	1990	Markum	1990
12 5030680	487780	12	5031720	482170	27	7	1990	Markum	1990
Taylor Creek									
12 4989650	478730	12	4991080	484120	9	8	1990	Markum	1990

**UPPER MISSOURI RIVER DRAINAGE: 100301**

**Dearborn/Missouri River Drainage: 10030102**

Dearborn River (tributaries covered separately)

12 5234710	377850	12	5236430	385580	30	4	1991	walk	Diamond and Finnegan 1993
12 5235380	383790	12	5236430	385580	13	5	1991	walk	Diamond and Finnegan 1993
12 5234030	382000	12	5243190	369580	12	5	1992	walk	Diamond and Finnegan 1993
Falls Creek									
12 5231550	387880	12	5236750	387850	13	5	1991	walk	Diamond and Finnegan 1993
12 5231550	387880	12	5236750	387850	3	8	1991	walk	Diamond and Finnegan 1993

**Sun River Drainage: 10030104**

Biggs Creek

12 5292020	363650	12	5288440	357150	17	7	1990	walk	Diamond and Finnegan 1993
Gibson Reservoir									
12 5273300	367540	12	5276650	360730	14	7	1990		Diamond and Finnegan 1993
12 5276620	360550	12	5273650	366980	6	4	1991		Diamond and Finnegan 1993

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM zon N/S utm	E/W utm zon N/S utm	Lower UTM zon N/S utm	E/W utm zon N/S utm	Da	Mo	Year	Type seen	#	Source	Comments
Moose Creek	12 5276620	360550	12 5273650	366980	16	4	1991			Diamond and Finnegan 1993	
	12 5276620	360550	12 5273650	366980	23	4	1991			Diamond and Finnegan 1993	
	12 5276620	360550	12 5273650	366980	25	4	1991			Diamond and Finnegan 1993	
	12 5276620	360550	12 5273650	366980	6	5	1991			Diamond and Finnegan 1993	
	12 5276620	360550	12 5273650	366980	15	5	1991			Diamond and Finnegan 1993	
	12 5276620	360550	12 5273650	366980	3	6	1991			Diamond and Finnegan 1993	
	12 5276620	360550	12 5273650	366980	17	7	1991			Diamond and Finnegan 1993	
	12 5276620	360550	12 5273650	366980	23	7	1991			Diamond and Finnegan 1993	
Rock Creek	12 5285350	349190	12 5287040	357200	15	7	1990	walk		Diamond and Finnegan 1993	
	12 5286190	352910	12 5287040	357200	2	6	1992	walk		Diamond and Finnegan 1993	
	12 5287250	355190	12 5287040	357200	5	6	1991	walk		Diamond and Finnegan 1993	
	12 5281490	339850	12 5287040	357200	17	7	1991	walk	1	Diamond and Finnegan 1993	
	12 5286190	352910	12 5287250	355190	9	8	1991	walk		Diamond and Finnegan 1993	
	12 5281490	339850	12 5287040	357200	16	8	1991	walk		Diamond and Finnegan 1993	
Sun River, North Fork (tributaries covered separately)	12 5246950	372430	12 5248530	373270	14	5	1991	walk		Diamond and Finnegan 1993	
	12 5285460	357370	12 5276620	360550	15	7	1990	walk		Diamond and Finnegan 1993	
	12 5293650	356310	12 5285460	357370	16	7	1990	walk		Diamond and Finnegan 1993	
	12 5303420	354870	12 5293650	356310	17	7	1990	walk		Diamond and Finnegan 1993	
	12 5288420	357150	12 5276620	360550	8	4	1991	walk		Diamond and Finnegan 1993	
	12 5277690	360400	12 5276620	360550	16	4	1991	walk		Diamond and Finnegan 1993	
	12 5285460	357370	12 5276620	360550	23	4	1991	walk	1	Diamond and Finnegan 1993	
	12 5285460	357370	12 5276620	360550	13	4	1992	walk		Diamond and Finnegan 1993	
	12 5285460	357370	12 5276620	360550	16	4	1992	walk		Diamond and Finnegan 1993	
	12 5285460	357370	12 5276620	360550	12	5	1992	walk		Diamond and Finnegan 1993	
	12 5285460	357370	12 5276620	360550	13	5	1992	walk	1	Diamond and Finnegan 1993	
	12 5285460	357370	12 5276620	360550	19	7	1992	walk		Diamond and Finnegan 1993	
	12 5285460	357370	12 5280070	358970	25	7	1992	walk		Diamond and Finnegan 1993	
	12 5282580	357310	12 5276620	360550	1	6	1992	walk	5	Diamond and Finnegan 1993	
	12 5303350	354890	12 5293680	356120	13	5	1992	walk		Diamond and Finnegan 1993	
	12 5287680	357500	12 5285460	357370	24	4	1991	walk	2	Diamond and Finnegan 1993	
	12 5285460	357370	12 5285460	357370	3	6	1991	walk		Diamond and Finnegan 1993	
	12 5293680	356120	12 5285460	357370	4	6	1991	walk	1	Diamond and Finnegan 1993	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydlogic Code**

Stream	Upper UTM		Lower UTM		#	Source	Comments				
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type seen	
	12	5293680	356120	12	5285460	357370	14	4	1992	walk	Diamond and Finnegan 1993
	12	5293680	356120	12	5285460	357370	28	4	1992	walk	Diamond and Finnegan 1993
	12	5293680	356120	12	5285460	357370	2	6	1992	walk	Diamond and Finnegan 1993
	12	5293680	356120	12	5285460	357370	26	7	1992	walk	Diamond and Finnegan 1993
	12	5285460	357370	12	5282610	357240	15	4	1992	walk	Diamond and Finnegan 1993
	12	5300430	356430	12	5293680	356120	5	6	1991	walk	3 Diamond and Finnegan 1993
	12	5286070	358970	12	5276620	360550	17	7	1991	walk	Diamond and Finnegan 1993
	12	5302520	355670	12	5293680	356120	18	7	1991	walk	1 Diamond and Finnegan 1993
	12	5302520	355670	12	5293680	356120	3	6	1992	walk	Diamond and Finnegan 1993
	12	5285460	357370	12	5276620	360550	7	8	1991	walk	Diamond and Finnegan 1993
	12	5292660	356330	12	5285460	357370	8	8	1991	walk	Diamond and Finnegan 1993
	12	5302520	355670	12	5293680	356120	10	8	1991	walk	5 Diamond and Finnegan 1993
	12	5293680	356120	12	5287040	357200	17	8	1991	walk	Diamond and Finnegan 1993
	12	5302520	355670	12	5293680	356120	18	8	1991	walk	Diamond and Finnegan 1993
Sun River, South Fork (tributaries covered separately)											
	12	5270400	356100	12	5275690	358790	27	4	1990	walk	1 Diamond and Finnegan 1993
	12	5262040	357280	12	5268030	355770	8	6	1990	walk	8 Diamond and Finnegan 1993
	12	5270400	356100	12	5263380	357500	16	7	1990	walk	10 Diamond and Finnegan 1993
	12	5262040	357280	12	5270400	356100	3	4	1991	walk	Diamond and Finnegan 1993
	12	5262040	357280	12	5259940	354770	3	4	1991	walk	Diamond and Finnegan 1993
	12	5262040	357280	12	5259940	354770	8	5	1992	walk	9 Diamond and Finnegan 1993
	12	5262040	357280	12	5259940	354770	27	5	1992	walk	4 Diamond and Finnegan 1993
	12	5270400	356100	12	5275690	358790	4	4	1991	walk	Diamond and Finnegan 1993
	12	5270400	356100	12	5275690	358790	16	4	1992	walk	Diamond and Finnegan 1993
	12	5262040	357280	12	5265030	356790	10	4	1991	walk	Diamond and Finnegan 1993
	12	5262040	357280	12	5270400	356100	17	4	1991	walk	Diamond and Finnegan 1993
	12	5262040	357280	12	5270400	356100	7	5	1992	walk	3 Diamond and Finnegan 1993
	12	5262040	357280	12	5276620	360550	19	5	1992	walk	15 Diamond and Finnegan 1993
	12	5270400	356100	12	5276620	360550	6	5	1992	walk	1 Diamond and Finnegan 1993
	12	5270400	356100	12	5276620	360550	29	5	1992	walk	6 Diamond and Finnegan 1993
	12	5259190	354770	12	5262040	357280	25	5	1991	walk	Diamond and Finnegan 1993
	12	5262040	357280	12	5268850	355450	26	4	1991	walk	5 Diamond and Finnegan 1993
	12	5262040	357280	12	5270400	356100	7	5	1991	walk	4 Diamond and Finnegan 1993
	12	5262040	357280	12	5270400	356100	13	4	1992	walk	Diamond and Finnegan 1993
	12	5262040	357280	12	5270400	356100	17	7	1992	walk	Diamond and Finnegan 1993

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydlogic Code**

Stream	Upper UTM						Lower UTM						#	Source	Comments
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type	seen				
	12	5262040	357280	12	5270400	356100	24	7	1992	walk	13	Diamond and Finnegan 1993			
	12	5270400	356100	12	5276620	360550	8	5	1991	walk	10	Diamond and Finnegan 1993			
	12	5270400	356100	12	5276620	360550	18	7	1992	walk	1	Diamond and Finnegan 1993			
	12	5262040	357280	12	5270400	356100	15	5	1991	walk	1	Diamond and Finnegan 1993			
	12	5270400	356100	12	5276620	360550	18	5	1991	walk	1	Diamond and Finnegan 1993			
	12	5262040	357280	12	5270400	356100	28	5	1991	walk	2	Diamond and Finnegan 1993			
	12	5262040	357280	12	5259940	354770	29	5	1991	walk	6	Diamond and Finnegan 1993			
	12	5262040	357280	12	5251400	357690	16	7	1992	walk	2	Diamond and Finnegan 1993			
	12	5262040	357280	12	5270400	356100	14	6	1991	walk	2	Diamond and Finnegan 1993			
	12	5268850	355450	12	5262040	357280	12	7	1991	walk	2	Diamond and Finnegan 1993			
	12	5262040	357280	12	5268850	355450	16	7	1991	walk	2	Diamond and Finnegan 1993			
	12	5273700	358500	12	5276620	360550	2	8	1991	walk	2	Diamond and Finnegan 1993			
	12	5262040	357280	12	5270400	356100	2	8	1991	walk	2	Diamond and Finnegan 1993			
	12	5270400	356100	12	5273700	358500	3	8	1991	walk	2	Diamond and Finnegan 1993			
	12	5262040	357280	12	5270400	356100	7	8	1991	walk	2	Diamond and Finnegan 1993			
	12	5262040	357280	12	5268850	355450	13	8	1991	walk	2	Diamond and Finnegan 1993			
<b>Sun River, West Fork</b>															
	12	5271020	345230	12	5268880	355470	17	7	1990	walk	6	Diamond and Finnegan 1993			
	12	5271020	345230	12	5268880	355470	9	5	1991	walk	6	Diamond and Finnegan 1993			
	12	5271020	345230	12	5268880	355470	16	5	1991	walk	6	Diamond and Finnegan 1993			
	12	5271020	345230	12	5268880	355470	15	7	1991	walk	6	Diamond and Finnegan 1993			
	12	5271020	345230	12	5268880	355470	5	8	1991	walk	6	Diamond and Finnegan 1993			
	12	5276180	344330	12	5271020	345230	6	8	1991	walk	6	Diamond and Finnegan 1993			
	12	5276180	344330	12	5268330	353830	29	5	1992	walk	6	Diamond and Finnegan 1993			
	12	5276180	344330	12	5268640	344480	18	7	1992	walk	6	Diamond and Finnegan 1993			
	12	5269050	347360	12	5268880	355470	5	5	1992	walk	2	Diamond and Finnegan 1993			
	12	5269050	347360	12	5268880	355470	28	5	1992	walk	4	Diamond and Finnegan 1993			
	12	5276180	344330	12	5268880	355470	14	8	1991	walk	2	Diamond and Finnegan 1993			
	12	5276180	344330	12	5268880	355470	18	7	1992	walk	2	Diamond and Finnegan 1993			
	12	5279630	342980	12	5276180	344330	15	8	1991	walk	9	Diamond and Finnegan 1993			
	12	5279630	342980	12	5269050	347360	6	5	1992	walk	9	Diamond and Finnegan 1993			
<b>Ahorn Creek</b>															
	12	5267780	344670	12	5268640	344480	6	8	1991	walk	6	Diamond and Finnegan 1993			
	12	5265550	344550	12	5268640	344480	14	8	1991	walk	1	Diamond and Finnegan 1993			
	12	5265790	344540	12	5268640	344480	27	5	1992	walk	1	Diamond and Finnegan 1993			
<b>Straight Creek</b>															
	12	5260860	357180	12	5254750	359650	9	6	1990	walk	6	Diamond and Finnegan 1993			
	12	5251580	360500	12	5260860	357780	3	4	1991	walk	6	Diamond and Finnegan 1993			

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM zon N/S utm	E/W utm zon N/S utm	Lower UTM E/W utm zon N/S utm	Da	Mo	Year	Type	seen	Source	Comments
	12 5251580	360500	12 5260860	357780	30	4	1991	walk	Diamond and Finnegan 1993	
	12 5251580	360500	12 5260860	357780	30	5	1991	walk	Diamond and Finnegan 1993	
	12 5251580	360500	12 5260860	357780	13	5	1992	walk	4 Diamond and Finnegan 1993	
	12 5251580	360500	12 5260860	357780	26	5	1992	walk	2 Diamond and Finnegan 1993	
	12 5253010	360670	12 5260860	357780	14	4	1992	walk	Diamond and Finnegan 1993	
	12 5253010	360670	12 5260860	357780	16	6	1992	walk	Diamond and Finnegan 1993	
	12 5259490	359280	12 5260860	357780	8	5	1992	walk	Diamond and Finnegan 1993	
	12 5248200	362690	12 5260860	357780	13	7	1991	walk	Diamond and Finnegan 1993	
	12 5256400	359180	12 5260860	357780	5	8	1991	walk	Diamond and Finnegan 1993	
Badger Creek	12 5347880	348810	12 5350900	350100	29	6	1990	walk	4 Diamond and Finnegan 1993	
	12 5345220	344440	12 5347880	348810	3	5	1991	walk	Diamond and Finnegan 1993	
	12 5345220	344440	12 5347880	348810	29	4	1992	walk	Diamond and Finnegan 1993	
	12 5345220	344440	12 5347880	348810	9	7	1992	walk	3 Diamond and Finnegan 1993	
	12 5345220	344440	12 5345160	345810	3	7	1991	walk	9 Diamond and Finnegan 1993	
	12 5345220	344440	12 5345810	347110	30	7	1991	walk	Diamond and Finnegan 1993	
Badger Creek, North							2			
	12 5347500	342390	12 5345220	344440	8	8	1990	walk	Diamond and Finnegan 1993	
	12 5347500	342390	12 5345220	344440	28	8	1990	walk	Diamond and Finnegan 1993	
	12 5341970	338630	12 5346540	341230	2	5	1991	walk	4 Diamond and Finnegan 1993	
	12 5341970	338630	12 5346540	341230	19	5	1992	walk	4 Diamond and Finnegan 1993	
	12 5346540	341230	12 5345220	344440	3	5	1991	walk	Diamond and Finnegan 1993	
	12 5341970	338630	12 5345220	344440	21	5	1991	walk	5 Diamond and Finnegan 1993	
	12 5341970	338630	12 5345220	344440	3	7	1991	walk	Diamond and Finnegan 1993	
	12 5345960	340900	12 5345220	344440	30	4	1992	walk	2 Diamond and Finnegan 1993	
	12 5345960	340900	12 5345220	344440	20	5	1992	walk	1 Diamond and Finnegan 1993	
	12 5340040	336830	12 5345220	344440	8	7	1992	walk	19 Diamond and Finnegan 1993	8-9 July 1992
	12 5341970	338630	12 5345960	340900	29	4	1992	walk	3 Diamond and Finnegan 1993	
Badger Creek, South										
	12 5340880	343550	12 5345220	344440	9	8	1990	walk	Diamond and Finnegan 1993	
	12 5335050	347150	12 5345220	344440	19	5	1992	walk	7 Diamond and Finnegan 1993	
	12 5333790	348010	12 5345220	344440	26	8	1990	walk	7 Diamond and Finnegan 1993	26-27 Aug 1990
	12 5338690	344130	12 5342980	344260	9	7	1992	walk	9 Diamond and Finnegan 1993	
	12 5343340	344250	12 5345220	344400	3	7	1991	walk	Diamond and Finnegan 1993	
	12 5343340	344250	12 5345220	344400	9	7	1992	walk	2 Diamond and Finnegan 1993	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydrologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo			
12	53338770	343340	12	5345220	344400	31	7	1991	walk	Diamond and Finnegan 1993	
Birch Creek											
Birch Creek, Middle Fork	12	5327750	354240	12	5331130	358340	25	8	1990	walk	Diamond and Finnegan 1993
	12	5330070	356880	12	5331130	358340	23	4	1991	walk	Diamond and Finnegan 1993
	12	5330070	356880	12	5331130	358340	5	7	1991	walk	Diamond and Finnegan 1993
	12	5330070	356880	12	5331130	358340	11	5	1992	walk	3 Diamond and Finnegan 1993
	12	5329300	354200	12	5331130	358340	28	7	1991	walk	Diamond and Finnegan 1993
	12	5329300	354200	12	5331130	358340	23	4	1992	walk	Diamond and Finnegan 1993
	12	5329730	355920	12	5331130	358340	15	5	1992	walk	3 Diamond and Finnegan 1993
Birch Creek, North Fork	12	5335210	353980	12	5335540	358700	6	7	1990	walk	Diamond and Finnegan 1993
	12	5333500	350140	12	5335210	353980	26	8	1990	walk	Diamond and Finnegan 1993
	12	5336110	356250	12	5335540	358700	8	4	1991	walk	Diamond and Finnegan 1993
	12	5335700	355300	12	5335540	358700	23	4	1991	walk	Diamond and Finnegan 1993
	12	5335700	355300	12	5335540	358700	30	4	1991	walk	2 Diamond and Finnegan 1993
	12	5335110	351530	12	5335540	358700	5	7	1991	walk	Diamond and Finnegan 1993
	12	5333500	350140	12	5335540	358700	9	7	1991	walk	Diamond and Finnegan 1993
	12	5335080	352900	12	5335540	358700	23	7	1991	walk	1 Diamond and Finnegan 1993
	12	5335210	353980	12	5335540	358700	23	4	1992	walk	Diamond and Finnegan 1993
	12	5335110	351530	12	5335540	358700	5	8	1992	walk	Diamond and Finnegan 1993
Birch Creek, South Fork	12	5331130	358340	12	5333310	359240	6	7	1990	walk	Diamond and Finnegan 1993
	12	5324080	357450	12	5331130	358340	24	8	1990	walk	5 Diamond and Finnegan 1993
	12	5329890	359320	12	5333310	359240	23	4	1991	walk	Diamond and Finnegan 1993
	12	5329890	359320	12	5333310	359240	5	7	1991	walk	Diamond and Finnegan 1993
	12	5324690	358010	12	5333310	359240	29	7	1991	walk	Diamond and Finnegan 1993
	12	5327190	359650	12	5333310	359240	14	5	1992	walk	3 Diamond and Finnegan 1993
	12	5328710	359870	12	5333310	359240	6	8	1992	walk	5 Diamond and Finnegan 1993
Paradise Creek	12	5370590	323400	12	5372240	324280	18	5	1993	walk	4 Ashley 1994b
Aster Creek	12	5370330	324430	12	53711860	323480	18	5	1993	walk	Ashley 1994b
Two Medicine River (tributaries covered separately)											
	12	5371630	322050	12	5370880	319240	19	5	1993	walk	2 Ashley 1994b
	12	5373400	325250	12	5373140	325190	19	5	1993	walk	Ashley 1994b
Two Medicine River, South Fork	12	5355390	329280	12	5350890	334090	22	6	1990	walk	Diamond and Finnegan 1993

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydlogic Code**

Stream	Upper UTM zon N/S utm	E/W utm zon N/S utm	Lower UTM E/W utm Da Mo Year	Type seen #	Source	Comments
	12 5355390	329280 12	5358650 333930 25 6 1990 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5355390 329280 30 8 1990 walk		Diamond and Finnegan 1993	
	12 5355390	329280 12	5358390 331500 24 4 1991 walk		Diamond and Finnegan 1993	
	12 5351740	332720 12	5355390 329280 1 5 1991 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5352050 332060 2 5 1991 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5352050 332060 22 5 1991 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5352050 332060 4 8 1991 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5355390 329280 31 7 1991 walk		Diamond and Finnegan 1993	
	12 5354730	329280 12	5359190 337240 22 4 1992 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5355390 329280 28 4 1992 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5358390 331500 1 5 1992 walk		Diamond and Finnegan 1993	
	12 5351420	336830 12	5355390 329280 18 5 1992 walk		Diamond and Finnegan 1993	
	12 5354730	329280 12	5358390 331500 21 5 1992 walk	2	Diamond and Finnegan 1993	
	12 5351420	336830 12	5355390 329280 8 7 1992 walk		Diamond and Finnegan 1993	

**Teton River Drainage: 10030205**

**Deep Creek**

**Deep Creek, North Fork**

12 5288580 377180 12 5291000 373330 20 5 1992 walk

**Deep Creek, South Fork**

12 5287280 376260 12 5287870 373230 19 5 1992 walk

**Teton River, North Fork**

12 5312950 365140 12 5309310 367900 28 7 1991 walk

12 5312950 365140 12 5309310 367900 7 5 1992 walk

12 5312950 365140 12 5309310 367900 4 8 1992 walk

12 5311090 366680 12 5308170 369800 21 4 1992 walk

12 5311770 365850 12 5309310 367900 6 6 1992 walk

**Teton River, South Fork**

12 5303120 373220 12 5303690 377500 31 7 1991 walk

12 5303120 373220 12 5303690 377500 21 4 1992 walk

12 5303120 373220 12 5303690 377500 4 8 1992 walk

12 5312900 365140 12 5312420 361840 3 5 1992 walk

Diamond and Finnegan 1993

**UPPER YELLOWSTONE RIVER DRAINAGE: 100700**

**Upper Yellowstone River Drainage: 10070002**

Big Creek

12 5016670 510440 12 5011510 496250 20 8 1991 walk

Johnson 1991

20-21 Aug 1991

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen			
<b>Bridge Creek</b>											
12 5013680	557530	12	5015100	559510	2	7	1991	walk		Johnson 1991	
Boulder River (tributaries covered separately)											
12 5016130	559580	12	5044000	562000	19	5	1990	walk	2	Markum 1990	
12 5031610	563350	12	5037640	560880	6	6	1990	walk		Markum 1990	
12 5016130	559580	12	5021090	560390	6	6	1990	walk	8	Markum 1990	
12 5016130	559580	12	5021090	560390	16	6	1990	walk		Markum 1990	
12 5031610	563350	12	5037640	560880	7	8	1990	walk		Markum 1990	
12 5021090	560390	12	5023330	562000	13	8	1990	walk		Markum 1990	
12 5016130	559580	12	5031610	563350	23	5	1990	walk	8	Markum 1990	
12 5037640	560880	12	5044000	562000	19	6	1991	walk		Johnson 1991	
12 5021090	560390	12	5037640	560880	20	6	1991	walk	2	Johnson 1991	
12 5016130	559580	12	5021090	560390	29	6	1991	walk	1	Johnson 1991	
12 5004350	560050	12	5006430	559320	4	7	1991	walk		Johnson 1991	
12 5008520	557970	12	5013900	559380	5	7	1991	walk		Johnson 1991	
Boulder River, East											
12 5042510	566710	12	5043960	566650	19	5	1990	walk		Markum 1990	
12 5037500	571670	12	5040050	571320	19	5	1990	walk		Markum 1990	
12 5037500	571670	12	5041250	568240	25	7	1990	walk		Markum 1990	
12 5041250	568240	12	5043960	566650	13	8	1990	walk		Markum 1990	
12 5043960	566650	12	5052350	568120	1	7	1991	walk	1	Johnson 1991	
12 5005030	564390	12	5009370	563630	3	7	1991	walk		Johnson 1991	
<b>Rainbow Creek</b>											
12 5009110	566860	12	5009370	563630	3	7	1991	walk		Johnson 1991	
<b>Boulder River, South Fork</b>											
12 5009950	558140	12	5007440	558350	4	7	1991	walk		Johnson 1991	
<b>Sheep Creek</b>											
12 5007480	558340	12	5006390	558450	4	7	1991	walk		Johnson 1991	
<b>Boulder River, West Fork</b>											
12 5036050	549720	12	5043860	553990	28	5	1990	walk		Markum 1990	
12 5034730	549990	12	5042590	553310	2	8	1990	walk		Markum 1990	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydrologic Code**

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen			
<b>Elk Creek</b>											
12 5047550	570190	12	5048230	569440	5	7	1991	walk			
Lambert Creek											
12 5007890	546300	12	5011110	545760	17	8	1991	walk			
Mill Creek (tributaries covered separately)											
12 5012680	540520	12	5013290	539190	21	5	1990	walk			
12 5014810	537310	12	5013290	539190	14	8	1990	walk			
12 5012000	545520	12	5017980	534110	18	8	1991	walk			
Mill Creek, East Fork											
12 5021230	548420	12	5017980	534110	16	8	1991	walk			
Mill Creek, West Fork											
12 5006020	533480	12	5016200	534570	22	8	1991	walk			
Passage Creek											
12 5008680	539230	12	5013290	539170	17	8	1991	walk			
Sixmile Creek											
12 5002750	526360	12	5011040	517940	24	8	1991	walk			
Sixmile Creek, North Fork											
12 5004390	528040	12	5008890	520180	24	8	1991	walk			
Speculator Creek											
12 5026740	558810	12	5026190	562590	22	6	1991	walk			
Upsidedown Creek											
12 5013610	563050	12	5014910	559570	30	6	1991	walk			
West Boulder River											
12 5032840	547700	12	5043870	553990	25	6	1991	walk			
12 5043870	555990	12	5056570	570060	14	6	1993	boat			
<b>Stillwater River Drainage: 10070005</b>											
Castle Creek											
12 5033850	584100	12	5033950	590180	8	8	1991	walk			
Cathedral Creek											
12 5027670	581560	12	5026340	581650	14	8	1991	walk			
Clarks Creek											
12 5001550	581240	12	5001920	578890	30	7	1991	walk			
Divide Creek											
12 5024680	570560	12	5023770	570690	13	8	1991	walk			
Falls Creek											
12 5014660	586440	12	5017860	583570	3	8	1991	walk			
Flood Creek											

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydrologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen			
	12	5016240	578270	12	5017500	583550	2	8	1991	walk	Johnson 1991
Glacier Creek	12	4999700	580290	12	5001020	579140	30	7	1991	walk	Johnson 1991
Horseshoe Creek	12	5018200	576650	12	5001650	578860	30	7	1991	walk	Johnson 1991
Initial Creek	12	5027640	582590	12	5028390	581920	14	8	1991	walk	Johnson 1991
Iron Creek	12	5028840	577050	12	5028450	581950	14	8	1991	walk	Johnson 1991
Lightning Creek	12	5023000	573780	12	5024480	574290	13	8	1991	walk	Johnson 1991
Pin Creek	12	5033850	584100	12	5033950	590180	9	8	1991	walk	Johnson 1991
Rosebud Creek, West	12	5010580	599630	12	5014140	606030	14	6	1990	walk	Markum 1990
	12	5007180	590090	12	5015890	608130	8	7	1991	walk	Johnson 1991
Huckleberry Creek	12	5008070	594240	12	5007080	593940	8	7	1991	walk	Johnson 1991
Stillwater River (tributaries covered separately)	12	5022630	586340	12	5026130	588390	12	6	1990	walk	Markum 1990
	12	5012910	582110	12	5022630	586340	13	6	1990	walk	Markum 1990
	12	5016070	583360	12	5022630	586340	29	8	1990	walk	Markum 1990
	12	5009210	580060	12	5016070	583360	29	8	1990	walk	Markum 1990
	12	5007650	579640	12	5022290	586050	31	7	1991	walk	Johnson 1991
	12	5022630	586340	12	5032040	594500	23	7	1993		Reichel and Genter 1994
Stillwater River, West Fork (tributaries covered separately)	12	5028390	581920	12	5032030	587300	10	8	1991	walk	Johnson 1991
	12	5017880	570680	12	5023770	507690	12	8	1991	walk	Johnson 1991
	12	5023770	507690	12	5027440	580870	13	8	1991	walk	Johnson 1991
Storm Creek	12	5009230	585380	12	5012910	582110	3	8	1991	walk	Johnson 1991
Trail Creek	12	5022900	569170	12	5022900	569960	13	8	1991	walk	Johnson 1991
Tumble Creek	12	5022790	575940	12	5024550	575950	13	8	1991	walk	Johnson 1991
											13-14 Aug 1991

**Clark's Fork of the Yellowstone River Drainage: 10070000**

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM zon N/S utm	Lower UTM E/W utm zon N/S utm	Da	Mo	Year	Type seen	Source	Comments
<b>KOOTENAI RIVER DRAINAGE: 170101</b>								
<b>Upper Kootenai River Drainage: 17010101</b>								
Big Creek								
11	5401680	615280	11	5400280	621700	19	5	1989
11	5393130	609390	11	5400280	621700	24	8	1989
11	5393130	609390	11	5400280	621700	13	6	1990
11	5397990	611730	11	5400500	621140	31	8	1990
11	5397990	611730	11	5400500	621140	10	7	1991
11	5397990	611730	11	5400500	621140	30	5	1993
11	5394360	610400	11	5400280	621700	7	5	1994
Callahan Creek								
11	5365000	574750	11	5364950	577530	11	6	1989 walk
11	5365000	574750	11	5364950	577530	23	7	1989 walk
North Fork Callahan Creek								
11	5364900	573100	11	5367420	582050	24	8	1990 walk
11	5364900	573100	11	5364950	577530	9	9	1990 walk
11	5364900	573100	11	5364950	577530	28	5	1991 walk
South Fork Callahan Creek								
11	5360560	567500	11	5366920	567100	23	5	1990 walk
11	5362500	570700	11	5366920	567100	23	7	1990 walk
11	5360560	567500	11	5366920	567100	28	5	1993 walk
Cedar Creek								
11	5362230	597210	11	5364020	600930	16	6	1990 walk
Cherry Creek								
11	5344000	607430	11	5347030	609190	11	8	1990 walk
11	5351060	608980	11	5352790	608870	15	8	1990 walk
Granite Creek								
11	5350600	604460	11	5351190	606080	24	6	1990 walk
11	5349750	601350	11	5351650	608650	14	8	1990 walk

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen			
Grave Creek											
11 5421800	664760	11	5417230	661340	19	5	1989		2	Kerr 1989	
11 5421800	664760	11	5418170	663220	1	6	1989		4	Kerr 1989	
					15	6	1989			Fairman, Genter, and Miller 198 Survey section unknown	
					21	6	1989			Fairman, Genter, and Miller 198 Survey section unknown	
					19	7	1989		1	Fairman, Genter, and Miller 198 19-20 July 1989, Survey	
					19	7	1989		2	Fairman, Genter, and Miller 199 17-18 June 1990	
					17	6	1990			Fairman, Genter, and Miller 1990	
					655030	2	1990			Fairman, Genter, and Miller 1990	
					655220	2	1990			Fairman, Genter, and Miller 1990	
					655030	10	5	1993		Reichel and Genter 1994	
					660730	8	5	1994		Reichel and Genter 1995	
					655030	31	7	1994		Reichel and Genter 1995	
					663220	1	8	1994		Reichel and Genter 1995	
Keeler Creek											
11 5356280	584620	11	5356700	585100	24	5	1989			Fairman, Genter, and Miller 1989	
11 5354000	577350	11	5356380	584620	21	6	1990			Fairman, Genter, and Miller 199 21-22 June 1990	
11 5353400	573900	11	5356380	584620	30	7	1990			Fairman, Genter, and Miller 199 30-31 July 1990	
Kootenai River (tributaries covered separately)											
11 5365700	600790	11	5367310	592040	25	7	1989			Kerr 1989	
11 5359730	615170	11	5361260	607560	8	5	1990			Fairman and Miller 1990	
11 5362600	624600	11	5366680	594240	17	5	1990			Fairman and Miller 1990	
11 5378900	575520	11	5366700	593900	3	8	1990			Fairman and Miller 1990	
11 5367440	591670	11	5366760	596490	12	8	1990			Fairman and Miller 1990	
11 5359730	615170	11	5361260	607560	17	8	1990			Fairman and Miller 1990	
Kootenai Falls area											
11 5367400	591600	11	5367200	590900	14	5	1989		3	Kerr 1989	
11 5367200	592300	11	5367200	590900	25	5	1989			Fairman, Genter, and Miller 1989	
11 5367200	592300	11	5367200	590900	28	5	1989		6	Kerr 1989	
11 5367400	591600	11	5367200	590900	4	6	1989			Fairman, Genter, and Miller 1989	
11 5367400	591600	11	5367200	590900	11	6	1989		1	Kerr 1989	
11 5367400	591600	11	5367200	590900	24	6	1989			Fairman, Genter, and Miller 1990	
11 5367200	592300	11	5367200	590900	8	5	1990			Fairman, Genter, and Miller 1990	
11 5367200	592300	11	5367200	590900	17	5	1990			Fairman, Genter, and Miller 1990	
11 5367400	591600	11	5367200	590900	20	5	1990		1	Fairman, Genter, and Miller 1990	
11 5367400	591600	11	5367200	590900	30	6	1990			Fairman, Genter, and Miller 1990	
11 5367200	592300	11	5367200	590900	21	7	1990			Fairman, Genter, and Miller 1990	
11 5367200	592300	11	5367200	590900	19	8	1990			Fairman, Genter, and Miller 1990	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydrologic Code**

Stream	Upper UTM zon N/S utm	E/W utm	Lower UTM zon N/S utm	E/W utm	Da	Mo	Year	Type seen	Source	#	Comments
Lake Creek					24	5	1989		Fairman, Genter, and Miller 1990		
Libby Creek	11 5330200	608100	11 5333680	609670	13	8	1990		Fairman, Genter, and Miller 1990		
Pinkham Creek	11 5410380	637190	11 5410070	630080	26	5	1990	walk	Fairman, Genter, and Miller 1989		
Pipe Creek	11 5364600	603980	11 5369010	607130	6	6	1989	walk	Fairman and Miller 1990		
	11 5378790	607070	11 5364600	603980	21	7	1989	walk	Fairman, Genter, and Miller 1989	Kerr 1989	
Pipe Creek, East Fork	11 5391750	606670	11 5385530	601890	5	7	1990	walk	Fairman and Miller 1990		
Quartz Creek	11 5366550	601440	11 5365700	600800	23	5	1989		Fairman and Miller 1990		
	11 5375900	599100	11 5365700	600800	22	7	1989		Fairman, Genter, and Miller 1989	Kerr 1989	
	11 5366550	601440	11 5365700	600800	8	5	1990		Fairman, Genter, and Miller 1990		
	11 5374550	599180	11 5372140	599470	8	5	1990		Fairman, Genter, and Miller 1990		
	11 5379000	598770	11 5367720	600960	14	6	1990		Fairman, Genter, and Miller 1990		
West Fork Quartz Creek	11 5373060	597500	11 5370200	599550	23	6	1990		Fairman, Genter, and Miller 1990		
Pinkham Creek	11 5410380	637190	11 5410070	630080	26	5	1989		Fairman, Genter, and Miller 1988	unknown stream segment	
Pipe Creek	11 5364600	603980	11 5369010	607130	9	6	1989		Fairman, Genter, and Miller 1990		
	11 5364600	603980	11 5369010	607130	21	7	1989		Fairman, Genter, and Miller 1989	Kerr 1989	
	11 5378790	607070	11 5364600	603980	5	7	1990		Fairman and Miller 1990		
Pipe Creek, East Fork	11 5391750	606670	11 5385530	601890	13	6	1990		Fairman and Miller 1990		
Ross Creek	11 5339700	580700	11 5339180	582450	12	7	1988		Miller 1988		
Spar Creek	11 5339700	580700	11 5339730	584030	20	6	1990	walk	Fairman and Miller 1990		
	11 5346660	577780	11 5344550	577830	31	7	1990	walk	Fairman and Miller 1990		
Sutton Creek					24	5	1989	walk	Fairman, Genter, and Miller 1988 Spar Lake		
					26	5	1989	walk	Fairman, Genter, and Miller 1988 unknown stream segment		

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydrologic Code

Stream	Upper UTM zon N/S utm	E/W utm	Lower UTM zon N/S utm	E/W utm	Da	Mo	Year	Type	seen	Source	Comments
Wigwam River											
11 5425800	657200	11	5427300	658660	8	7	1992	walk			Reichel and Genter 1993
11 5427760	659010	11	5425810	657210	6	6	1994	walk			Reichel and Genter 1993
Young Creek											Fairman, Genter, and Miller 198 unknown stream segment
					26	5	1989				

**Fisher River Drainage: 17010102**

Fisher River (tributaries covered separately)

11 5341600	628380	11	5357680	624450	9	7	1990	walk			Fairman and Miller 1990
11 5325180	621150	11	5357680	624450	20	8	1990	walk			Fairman and Miller 1990
Fisher River, East											
					20	6	1989	walk			Fairman and Miller 1990
Fisher River, Silver Butte											unknown stream segment
11 5318190	621810	11	5313980	616290	12	8	1989	walk			Kerr 1989
Fisher River, West											
11 5323080	617200	11	5324510	620450	19	6	1989	walk			Fairman, Genter, and Miller 1989
11 5323520	611700	11	5324510	620450	11	8	1989	walk			Kerr 1989
11 5323520	611700	11	5324510	620450	3	7	1990	walk			Fairman, Genter, and Miller 1990
11 5321520	614860	11	5324510	620450	15	8	1990	walk			Fairman, Genter, and Miller 1990
Wolf Creek					5	6	1989	walk			

**Yaak River Drainage: 17010103**

Basin Creek					11	7	1990	walk			Merz 1991
Pete Creek											unknown stream segment
11 5416500	587400	11	5409150	590410	25	5	1989	walk			
11 5417690	586610	11	5409150	590410	15	7	1991	walk			
Seventeenmile Creek											
11 5392050	585530	11	5392080	587500	25	5	1989				Fairman, Genter, and Miller 1989
11 5389560	591310	11	5391600	587500	19	8	1989				Kerr 1989
11 5391120	588700	11	5392080	587500	21	5	1990				Fairman, Genter, and Miller 1990
11 5391120	588700	11	5392080	587500	13	7	1990				Fairman, Genter, and Miller 1990
Spread Creek											
11 5408200	584300	11	5407750	584400	25	5	1989				Fairman, Genter, and Miller 1989
11 5413100	578580	11	5407750	584400	18	8	1989				Kerr 1989
11 5410650	583090	11	5407750	584400	21	5	1990				Fairman, Genter, and Miller 1990

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen		Fairman, Genter, and Miller 1990	
11 5410650	583090	11	5407750	584400	11	7	1990			Merz 1991	
11 5413100	578580	11	5407750	584400	15	7	1991				
Yaak River (tributaries covered separately)											
11 5411730	598160	11	5396820	582820	31	7	1989			Kerr 1989	
11 5417780	598180	11	5409300	594970	22	5	1990			Fairman and Miller 1990	
11 5409210	588120	11	5406320	582720	1	7	1990			Fairman and Miller 1990	
11 5406320	582720	11	5388750	582190	7	8	1990			Fairman and Miller 1990	
11 5419510	598040	11	5388750	582190	17	7	1991			Fairman and Miller 1990	
11 5405330	580300	11	5392850	584110	29	5	1993	boat		Reichel and Genter 1994	
Yaak River, East Fork (tributaries covered separately)											
11 5422180	601810	11	5420950	612150	31	7	1989			Kerr 1989	
11 5422040	610530	11	5422870	601430	16	7	1990			Fairman and Miller 1990	
Yaak River, North Fork (tributaries covered separately)										31 July & 17 Aug 1989 16-17 July 1990	
11 5422870	601430	11	5427880	599390	17	8	1989			Kerr 1989	
11 5426660	600450	11	5422870	601430	20	5	1990			Fairman and Miller 1990	
11 5427880	599390	11	5422870	601430	16	7	1990			Fairman and Miller 1990	
Yaak River, South Fork (tributaries covered separately)											
11 5407290	596180	11	5399080	599540	19	8	1989			Kerr 1989	
11 5404600	598040	11	5408780	596310	9	8	1990			Fairman and Miller 1990	
Yaak River, West Fork (tributaries covered separately)											
11 5420330	593780	11	5420730	597300	26	5	1989			Fairman, Genter, and Miller 1989	
11 5423250	591800	11	5420330	593780	29	7	1989			Kerr 1989	
11 5420330	593780	11	5420730	597300	20	5	1990			Fairman, Genter, and Miller 1990	
11 5423250	591800	11	5420730	597300	14	7	1990			Fairman, Genter, and Miller 1990	
11 5421050	597700	11	5427900	568650	20	7	1990			Fairman, Genter, and Miller 1990	
11 5420400	593400	11	5420730	597300	22	7	1990			Fairman, Genter, and Miller 1990	

## CLARK FORK RIVER DRAINAGE: 170102

### Rock Creek Drainage: 17010202

Rock Creek (tributaries covered separately)

### Blackfoot River Drainage: 17010203

Blackfoot River (tributaries covered separately)

### Blackfoot River, Lander's Fork (tributaries covered separately)

### Blackfoot River, North Fork

Fairman and Miller 1990

Reichel and Genter 1995

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydologic Code**

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen	Castrén 1991		
	12 5223800	3533250	12 5228570	3550500	28	8	1991				
12 5228570	3550500	12 5209250	3460600	21	8	1992					
12 5219490	350570	12 5209250	3460600	15	6	1993					
12 5227710	3549490	12 5213170	351130	21	7	1993					
12 5227710	3549490	12 5223800	3533270	15	7	1994					
<b>Monture Creek</b>											
12 5220340	337230	12 5222880	336530	27	8	1991					
12 5227470	336250	12 5221830	336840	13	7	1994					
<b>Big Creek</b>											
11 5246560	617770	11 5247670	620910	16	6	1989					
11 5246560	617770	11 5247670	620910	25	7	1989					
11 5245260	615400	11 5247670	620910	2	7	1990					
11 5245260	615400	11 5247670	620910	29	8	1990					
<b>Cedar Creek</b>											
11 5222880	653320	11 5226950	661920	21	6	1989					
11 5222880	653320	11 5226950	661920	2	8	1989					
<b>Deer Creek</b>											
11 5246030	623480	11 5248150	623850	25	7	1989					
<b>Little Joe Creek</b>											
11 5235490	638830	11 5239630	642130	20	6	1989					
11 5235490	638830	11 5239630	642130	31	7	1989					
<b>Packer Creek</b>											
11 5256000	613250	11 5251740	612400	15	6	1989					
11 5253400	612050	11 5251740	612400	26	7	1989					
<b>Packer Creek, West Fork</b>											
11 5255320	610800	11 5253400	612050	16	6	1989					
<b>St. Regis River (tributaries covered separately)</b>											
11 5252020	607420	11 5239630	643990	13	6	1989					
11 5252020	607420	11 5239630	643990	13	6	1989					
11 5248190	623900	11 5241130	633610	3	7	1990					
11 5248190	623900	11 5241130	633610	28	8	1990					
<b>Trout Creek</b>											
11 5216190	658100	11 5322320	663080	22	6	1989	6	Fairman and Miller 1990			
11 5212870	656230	11 5322320	663080	1	8	1989	5	Miller 1989			
11 5211950	655780	11 5322320	663080	5	7	1990	1	Fairman, Genter, and Miller 199 5-6 Jul 1990			
11 5211950	655780	11 5323170	664620	29	8	1990		Fairman, Genter, and Miller 199 29-30 Aug 1990			

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydologic Code**

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo			
Twelvemile Creek	11	5217880	659080	11	5323170	664620	17	8	1991	Merz 1991	
	11	5214300	657400	11	5216190	658100	17	8	1991	Merz 1991	
	11	5214300	657400	11	5322730	663690	7	8	1992	Reichel and Genter 1993	
	11	5207630	652850	11	5322730	663690	4	8	1993	Reichel and Genter 1994	
Ward Creek	11	5247750	631260	11	5245220	629090	19	6	1989	Miller 1989	
	11	5249460	632210	11	5245220	629090	27	7	1989	Miller 1989	
	11	5239800	632150	11	5241130	633540	31	7	1989	Miller 1989	
<b>North Fork Flathead River Drainage: 17010206</b>											
Akakola Creek											
Big Creek	11	5408940	698690	11	5407140	699470	18	8	1993	walk	Ashley 1994b
	11	5386250	704680	11	5387080	709130	17	5	1990		2
	11	5386250	704680	11	5387080	709130	9	8	1990	Carlson 1990	
	11	5386250	704680	11	5387080	709130	15	5	1992	Carlson 1990	
	11	5384450	698940	11	5387080	709130	12	6	1992	Reichel and Genter 1993	
	11	5383270	698180	11	5387080	709130	14	8	1992	Reichel and Genter 1993	
	11	5383270	698180	11	5387080	709130	5	5	1993	Reichel and Genter 1993	
	11	5383950	698320	11	5387080	709130	9	8	1993	Reichel and Genter 1994	
	11	5386250	704680	11	5387080	709130	19	5	1994	Reichel and Genter 1995	
	11	5383950	698320	11	5386250	704680	3	6	1994	Reichel and Genter 1995	
	11	5383950	698320	11	5387080	709130	2	8	1994	Reichel and Genter 1995	
Bowman Creek	11	5411920	705810	11	5406720	699220	18	8	1993	Ashley 1994b	
Canyon Creek	11	5376530	703530	11	5376050	707810	17	5	1990	Carlson 1990	
	11	5376530	703530	11	5376050	707810	9	8	1990	Carlson 1990	
	11	5376050	707810	11	5376450	711310	4	6	1994	Reichel and Genter 1995	
Coal Creek	11	5394330	704820	11	5396590	706510	16	5	1990	Carlson 1990	
	11	5393790	702750	11	5396590	706510	11	8	1990	Carlson 1990	
	11	5394330	704820	11	5396590	706510	13	6	1992	Reichel and Genter 1993	
	11	5394310	690770	11	5394550	697570	13	8	1992	Reichel and Genter 1993	
	11	5393790	702750	11	5396590	706510	17	6	1993	Reichel and Genter 1994	
	11	5393790	702750	11	5396590	706510	13	5	1994	Reichel and Genter 1995	
	11	5394550	697570	11	5393790	702750	8	6	1994	Reichel and Genter 1995	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM zon N/S utm				Lower UTM E/W utm zon N/S utm				E/W utm	Da	Mo	Year	Type seen	#	Source	Comments
Hay Creek										6	1989				Fairman, Genter, and Miller 198 survey segment unknown	
Kintla Creek	11	5423460	694510	11	5421070	692440	19	8	1993						Gangemi 1991	
	11	5428380	704630	11	5427990	701620	29	7	1994						Ashley 1994b	
	11	5428870	708740	11	5428540	708690	30	7	1994						Ashley 1994a	
Kishenehn Creek	11	5430700	692890	11	5424950	698530	5	8	1993						Ashley 1994a	
Moose Creek										1991					Gangemi 1991	
Moran Creek										1991					survey segment unknown	
North Fork Flathead River (tributaries covered separately)																
	11	5430420	684710	11	5406600	699820	6	8	1991					1	Gangemi 1991	
	11	5430420	684710	11	5413930	694260	12	8	1993						Ashley 1994b	
	11	5394780	706930	11	5390730	709620	14	5	1992					3	Reichel and Genter 1993	
	11	5394330	704820	11	5384160	710440	1	4	1993					3	Reichel and Genter 1994	
	11	5410050	691050	11	5409150	694800	17	6	1993						Reichel and Genter 1994	
Red Meadow Creek	11	5410050	691050	11	5409150	694800	30	5	1990						Carlson 1990	
	11	5410050	691050	11	5409050	696490	8	8	1990						Carlson 1990	
	11	5410050	691050	11	5409050	696490	13	8	1992						Reichel and Genter 1993	
Trail Creek										6	1989				Fairman, Genter, and Miller 198 survey segment unknown	
	11	5421900	687500	11	5421700	689930	6	5	1990					8	Carlson 1990	
	11	5423550	681800	11	5421700	689930	14	5	1990					10	Carlson 1990	
	11	5423550	681800	11	5421700	689930	7	8	1990					8	Carlson 1990	
	11	54223550	680000	11	5421700	689930	5	8	1991					9	Gangemi 1991	
	11	5423550	681800	11	5421700	689930	14	5	1992					8	Reichel and Genter 1993	
	11	5423550	681800	11	5421700	689930	10	6	1992					6	Reichel and Genter 1993	
	11	5422450	680000	11	5421700	689930	12	8	1992					10	Reichel and Genter 1993	
	11	5422930	680830	11	5422000	691400	8	5	1993					15	Reichel and Genter 1994	
	11	5423400	681380	11	5421900	687500	9	5	1993					13	Reichel and Genter 1994	
	11	5423100	681060	11	5421900	687500	13	8	1993					10	Reichel and Genter 1994	
	11	5422450	680000	11	5422000	691400	9	5	1994	walk				12	Reichel and Genter 1994	
	11	5422450	680000	11	5422000	691400	1	8	1994	walk				6	Reichel and Genter 1994	
Tuchuck Creek															1-2 Aug 1994	

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Stream	Upper UTM						Lower UTM						#	Source	Comments
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo	Year	Type seen	Gangemi 1991	Gangemi 1991			
Yakiniak Creek							1991								
Whale Creek							1991								survey segment unknown
	11	5415370	686130	11	5414090	693550	6	1989							Fairman, Genter, and Miller 1989
	11	5415370	686130	11	5414090	693550	15	5	1990						Carlson 1990
							11	8	1990						Carlson 1990
	11	5413480	675900	11	5414090	693550	12	8	1993						Gangemi 1991
Akinkoka Creek							1991								survey segment unknown
Ninko Creek							1991								Reichel and Genter 1994
Shorty Creek							1991								survey segment unknown
	11	5410720	675550	11	5413590	676530	12	8	1993						Gangemi 1991
							1991								survey segment unknown
	11	5410720	675550	11	5413590	676530	12	8	1993						Reichel and Genter 1994
							1991								survey segment unknown
Dolly Varden Creek							1991								
	12	5325910	332670	12	5320440	336240	18	8	1991						Castrén 1991
	12	5322240	335090	12	5325910	332670	30	7	1993						Reichel and Genter 1994
Fish Creek							1991								30-31 July 1993
	12	5383090	279300	12	5381090	279970	11	5	1994						
	12	5383090	279300	12	5381090	279970	4	6	1994						2 Ashley 1994b
	12	5383090	279300	12	5381090	279970	6	8	1994						Ashley 1994b
	12	5381490	279760	12	5381090	279970	24	5	1994						Ashley 1994b
	12	5381490	279760	12	5381090	279970	4	5	1994						Ashley 1994a
	12	5383090	279300	12	5381090	279970	9	5	1994						Ashley 1994a
	12	5381490	279760	12	5381090	279970	25	7	1994						Ashley 1994a
	12	5383090	279300	12	5381090	279970	1	8	1994						Ashley 1994a
	12	5386930	289260	12	5386620	289220	27	5	1993						Ashley 1994b
Fern Creek							1993								
	12	5382070	278940	12	5381820	279660	9	5	1994						Ashley 1994a
Jackson Creek							1994								
	12	5387300	289320	12	5388140	287610	28	5	1993						Ashley 1994b
	12	5387900	288600	12	5388140	287610	24	4	1994						Ashley 1994a
	12	5387300	289320	12	5388140	287610	18	5	1994						Ashley 1994a
Lake Creek							1994								

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Drainage: Hydlogic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen			
12	5330120	327280	12	5331280	325640	31	7	1993	Reichel and Genter 1994		
<b>Long Creek</b>											
	12	5336590	311940	12	5334230	321340	1	8	1993		Reichel and Genter 1994
<b>McDonald Creek (tributaries covered separately)</b>											
	11	5376610	721230	12	5379300	278960	14	6	1994		Ashley 1994b
	12	5376610	721230	12	5379300	278960	15	4	1994		Ashley 1994a
	12	5400330	296730	12	5390390	288650	17	4	1974	3	Kuchel 1977
	12	5400330	296730	12	5390390	288650	24	4	1974	5	Kuchel 1977
	12	5400330	296730	12	5390390	288650	1	5	1974	23	Kuchel 1977
	12	5400330	296730	12	5390390	288650	8	5	1974	20	Kuchel 1977
	12	5400330	296730	12	5390390	288650	15	5	1974	31	Kuchel 1977
	12	5400330	296730	12	5390390	288650	22	5	1974	32	Kuchel 1977
	12	5400330	296730	12	5390390	288650	29	5	1974	32	Kuchel 1977
	12	5400330	296730	12	5390390	288650	5	6	1974	23	Kuchel 1977
	12	5400330	296730	12	5390390	288650	12	6	1974	12	Kuchel 1977
	12	5400330	296730	12	5390390	288650	19	6	1974	11	Kuchel 1977
	12	5400330	296730	12	5390390	288650	26	6	1974	11	Kuchel 1977
	12	5400330	296730	12	5390390	288650	3	7	1974	11	Kuchel 1977
	12	5400330	296730	12	5390390	288650	10	7	1974	9	Kuchel 1977
	12	5400330	296730	12	5390390	288650	17	4	1975	2	Kuchel 1977
	12	5400330	296730	12	5390390	288650	24	4	1975	4	Kuchel 1977
	12	5400330	296730	12	5390390	288650	1	5	1975	26	Kuchel 1977
	12	5400330	296730	12	5390390	288650	8	5	1975	30	Kuchel 1977
	12	5400330	296730	12	5390390	288650	15	5	1975	40	Kuchel 1977
	12	5400330	296730	12	5390390	288650	22	5	1975	41	Kuchel 1977
	12	5400330	296730	12	5390390	288650	29	5	1975	40	Kuchel 1977
	12	5400330	296730	12	5390390	288650	26	6	1975	43	Kuchel 1977
	12	5400330	296730	12	5390390	288650	3	7	1975	15	Kuchel 1977
	12	5400330	296730	12	5390390	288650	10	7	1975	10	Kuchel 1977
	12	5404230	292670	12	5390390	288650	10	8	1992	43	Reichel and Genter 1993
	12	5400330	296730	12	5390390	288650	2	9	1992	27	Reichel and Genter 1993
	12	5400330	296730	12	5390390	288650	17	4	1993	2	Ashley 1994b
	12	5400330	296730	12	5390390	288650	24	4	1993	7	Ashley 1994b
	12	5400330	296730	12	5390390	288650	8	5	1993	37	Ashley 1994b

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 Drainage: Hydrologic Code

Stream	Upper UTM zon N/S utm	E/W utm	zon N/S utm	E/W utm	Lower UTM zon N/S utm	E/W utm	Da	Mo	Year	Type seen	#	Source	Comments
	12 5400330	296730	12	5390390	288650	15	5	1993			21	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	25	5	1993			22	Ashley 1994b	
	12 5403580	292390	12	5400330	296730	26	5	1993			10	Ashley 1994b	
	12 5408750	286890	12	5403580	292390	10	6	1993			3	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	8	6	1993			27	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	15	6	1993			15	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	22	6	1993			12	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	29	6	1993			11	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	6	7	1993			16	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	13	7	1993			13	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	20	7	1993			14	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	27	7	1993			13	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	3	8	1993			9	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	10	8	1993			3	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	17	8	1993			3	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	24	8	1993			13	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	31	8	1993			14	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	14	9	1993			5	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	22	9	1993			5	Ashley 1994b	
	12 5400330	296730	12	5390390	288650	30	9	1993			20	Reichel and Genter 1994	10-11 Aug 1993
	12 5404230	292670	12	5390390	288650	10	8	1993			33	Ashley 1994a	
	12 5400330	296730	12	5390390	288650	28	4	1994			10	Ashley 1994a	
	12 5400330	296730	12	5390390	288650	8	6	1994			19	Ashley 1994a	
	12 5400330	296730	12	5390390	288650	16	8	1994			10	Ashley 1994a	
	12 5403580	292390	12	5400330	296730	28	4	1994			6	Ashley 1994a	
	12 5390390	288650	12	5400330	296730	3	8	1994			8	Ashley 1994a	
	12 5390390	288650	12	5400330	296730	4	8	1994			6	Ashley 1994a	
	12 5404870	290430	12	5403580	292390	3	8	1994			4	Ashley 1994b	
Avalanche Creek													
	12 5392030	295830	12	5392290	295060	3	6	1993			2	Ashley 1994b	
	12 5392290	295060	12	5393230	294640	10	5	1993			2	Ashley 1994b	
	12 5392290	295060	12	5393230	294640	7	7	1993			3	Ashley 1994b	
	12 5392290	295060	12	5393230	294640	2	8	1993			3	Ashley 1994b	
	12 5392290	295060	12	5393230	294640	10	8	1993			4	Ashley 1994b	

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Stream	Upper UTM zon N/S utm	E/W utm	zon N/S utm	Lower UTM E/W utm	Da	Mo	Year	Type seen	#	Source	Comments
Logan Creek	12 5399230	294640	12 5395540	292450	3	6	1993		2	Ashley 1994b	
	12 5393230	294640	12 5395540	292450	2	8	1993			Ashley 1994b	
	12 5395540	292450	12 5393230	294640	1	8	1993			Reichel and Genter 1994	
	12 5393230	294640	12 5395540	292450	9	5	1994		2	Ashley 1994a	
	12 5393230	294640	12 5395540	292450	8	6	1994			Ashley 1994a	
	12 5392290	295060	12 5393230	294640	9	5	1994		2	Ashley 1994a	
	12 5392290	295060	12 5393230	294640	8	6	1994			Ashley 1994a	
	12 5392290	295060	12 5393230	294640	22	7	1994			Ashley 1994a	
Mineral Creek	12 5399700	298350	12 5400330	296730	16	5	1993			Ashley 1994b	
	12 5404240	292650	12 5403580	292390	16	5	1993			Ashley 1994b	
	12 5404240	292650	12 5403580	292390	26	5	1993			Ashley 1994b	
	12 5404240	292650	12 5403580	292390	28	5	1994		2	Ashley 1994a	
	12 5404240	292650	12 5403580	292390	3	8	1994			Ashley 1994a	
	12 5404240	292650	12 5403580	292390	4	8	1994			Ashley 1994a	
	12 5404240	292650	12 5403580	292390	11	8	1992		3	Reichel and Genter 1993	
	12 5404240	292650	12 5403580	292390	11	8	1993			Reichel and Genter 1994	
Middle Fork Flathead River (tributaries covered separately)											
	12 5318340	345210	12 5345280	309430	20	8	1991			Castrén 1991	20-23 Aug 1991
	12 5345280	309430	12 5366360	296270	30	7	1992			Reichel and Genter 1993	30-31 Jul 1992
	12 5330950	328160	12 5349830	306190	1	8	1993		11	Reichel and Genter 1994	1-3 Aug 1993
Morrison Creek	12 5335560	331930	12 5344230	331810	28	7	1993			Reichel and Genter 1994	28-29 July 1993
Ole Creek	12 5351850	312750	12 5351740	307270	12	8	1992			Reichel and Genter 1993	
Schafer Creek	12 5324900	332640	12 5326450	332360	21	8	1991			Castrén 1991	
	12 5322260	330340	12 5326450	332360	30	7	1993			Reichel and Genter 1994	
Snyder Creek	12 5387690	290020	12 5388700	287760	27	5	1993			Ashley 1994b	
	12 5387690	290020	12 5388700	287760	20	5	1994		4	Ashley 1994a	
	12 5388170	288710	12 5388700	287760	24	5	1994			Ashley 1994a	
Sprague Creek	12 5387050	298330	12 5387560	287450	27	5	1993		4	Ashley 1994b	
	12 5386610	287900	12 5387560	287450	24	4	1994			Ashley 1994a	
	12 5386970	287700	12 5387560	287450	11	5	1994			Ashley 1994a	
	12 5387050	298330	12 5387560	287450	18	5	1994			Ashley 1994a	

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Stream	Upper UTM zon N/S utm	E/W utm	Lower UTM zon N/S utm	E/W utm	Da	Mo	Type seen	#	Source	Comments
Strawberry Creek	12 5386970	287700	12 5387560	287450	1	8	1994		Ashley 1994a	
unnamed creek	12 5318530	347830	12 5317680	346510	20	8	1991		Castren 1991	
	12 5380860	284230	12 5381900	283000	24	4	1994		Ashley 1994a	
<b>South Fork Flathead River Drainage: 17010209</b>										
Aeneas Creek	12 5334550	288450	12 5334280	290140	31	8	1989		Miller 1989	
Babcock Creek	12 5247590	321460	12 5248130	328660	22	7	1991		Castren 1991	
	12 5248040	325710	12 5248130	328660	16	7	1992		Reichel and Genter 1993	
Bartlett Creek	12 5263100	327390	12 5264480	328800	19	7	1992		Reichel and Genter 1993	
Big Salmon Creek	12 5270940	312360	12 5276540	322850	2	8	1991		Castren 1991	
	12 5269580	310480	12 5272190	315980	22	7	1992		Reichel and Genter 1993	
	12 5276540	322850	12 5278090	322950	23	7	1992		Reichel and Genter 1993	
Bunker Creek	12 5298280	316140	12 5299980	319230	5	6	1990		Carlson 1990	
	12 5297290	313960	12 5299980	319230	2	8	1990		Carlson 1990	
	12 5297290	313960	12 5299980	319230	6	8	1991		Castren 1991	
	12 5297290	313960	12 5299980	319230	22	6	1992		Reichel and Genter 1993	
	12 5297290	313960	12 5299980	319230	26	5	1994		Reichel and Genter 1993	
Clayton Creek	12 5344560	286420	12 5346650	288000	30	8	1989		Miller 1989	
Danaher Creek	12 5248300	344900	12 5256750	355440	24	7	1991		Castren 1991	
	12 5253540	340220	12 5256750	355440	17	7	1992		Reichel and Genter 1993	
Doris Creek	12 5353430	278230	12 5354340	278930	20	6	1990		Carlson 1990	
	12 5353430	278230	12 5354340	278930	3	8	1990		Carlson 1990	
	11 5352020	720060	12 5353430	278230	6	8	1992		Reichel and Genter 1993	
Emery Creek	12 5362140	283230	12 5359840	283200	1	9	1989		Miller 1989	
	12 5364360	284380	12 5359840	283200	6	6	1990		Carlson 1990	
	12 5364360	284380	12 5359840	283200	10	8	1990		Carlson 1990	
Fawn Creek										

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Drainage: Hydologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Mo	Year	Type seen	Gargemi 1991			
					1991						survey segment unknown
Gordon Creek	12 5256390	328670	12 5255460	327500	27	6	1991		Castrén 1991 Castrén 1991 Reichel and Genter 1993		
	12 5253090	320060	12 5255460	327500	18	7	1991				
	12 5255460	320500	12 5260520	332450	18	7	1992				
Graves Creek	12 5338700	287320	12 5333880	291060	30	8	1989		Miller 1989 30-31 August 1989		
	12 5271290	325410	12 5272290	327060	30	7	1991				
Hungry Horse Creek	12 5358540	288780	12 5358670	284760	1	9	1989		Miller 1989 Carlson 1990 Carlson 1990		
	12 5359350	287340	12 5358670	284760	6	6	1990				
	12 5359350	287340	12 5358670	284760	10	8	1990				
Little Salmon Creek	12 5279850	316080	12 5280400	322800	3	8	1991	1	Castrén 1991 Reichel and Genter 1993 Reichel and Genter 1995		
	12 5280400	313030	12 5280400	322800	23	7	1992	10		23-24 July 1992	
	12 5280170	308030	12 5280400	322800	21	7	1994	8		21, 24-25 July 1994	
Lost Johnny Creek	12 5352410	279330	12 5354280	279970	22	5	1990		Castrén 1990 Carlson 1990 Carlson 1990		
	12 5351510	279090	12 5354280	279970	20	6	1990				
	12 5351510	279090	12 5354280	279970	10	8	1990				
Mid Creek	12 5295470	321000	12 5294800	319730	23	6	1992		Reichel and Genter 1993 Castrén 1991		
	12 5352890	290920	12 5352080	292750	26	8	1991				
Riverside Creek	12 5354100	291500	12 5352400	290980	26	8	1991		Castrén 1991		
	12 5256750	335440	12 5271600	326550	24	6	1991			24-28 June 1991	
	12 5296000	319000	12 5300250	319260	2	7	1991	2			
Ryle Creek	12 5260520	332450	12 5319800	307120	29	7	****	3	Castrén 1991 Castrén 1991 Reichel and Genter 1993	29 July - 5 August 1991	
	12 5300250	319260	12 5319800	307120	25	8	1991	3			
	12 5294800	319730	12 5319800	307120	23	6	1992	4		26-27 July 1992	
Spotted Bear River	12 5356750	335440	12 5311600	310550	26	7	1992		Carlson 1990 Carlson 1990 Castrén 1991		
	12 5312400	317300	12 5311600	310500	4	6	1990				
	12 5310200	323050	12 5311600	310500	1	8	1990	2		7-14 July 1991	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydologic Code**

Stream	Upper UTM		Lower UTM		#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm			
Sullivan Creek	12 5310350	328960	12 5311600	310500	24 6 1992	Reichel and Genter 1993	
	12 5311150	327900	12 5311600	310500	13 8 1992	Reichel and Genter 1993	
	12 5307070	332600	12 5311600	310500	14 8 1993	Reichel and Genter 1994	14-15 Aug 1993
	12 5310200	323050	12 5311600	310500	9 6 1994	Reichel and Genter 1995	
	12 5307520	331420	12 5311600	310500	5 8 1994	Reichel and Genter 1995	
	12 5316780	300800	12 5320250	298100	20 6 1990	Carlson 1990	
	12 5316780	300800	12 5320250	298100	30 7 1990	Carlson 1990	
					19 8 1991	Gangemi 1991	
	12 5316100	301900	12 5324950	299750	25 6 1992	Reichel and Genter 1993	
	12 5316780	300800	12 5324950	299750	8 8 1992	Reichel and Genter 1993	
	12 5314600	302270	12 5316780	300800	4 5 1993	Reichel and Genter 1994	
	12 5316780	300800	12 5325900	299850	5 5 1993	Reichel and Genter 1994	
	12 5316780	300800	12 5324950	299750	16 8 1993	Reichel and Genter 1994	
	12 5316100	301900	12 5324950	299750	9 6 1994	Reichel and Genter 1995	
	12 5316780	300800	12 5324950	299750	5 8 1994	Reichel and Genter 1995	
Ball Creek					1991	Gangemi 1991	
Branch Creek					1991	Gangemi 1991	survey segment unknown
Conner Creek					1991	Gangemi 1991	survey segment unknown
Quintonkon Creek					1991	Gangemi 1991	survey segment unknown
	12 5322210	297200	12 5322480	298220	30 7 1990	Carlson 1990	
	12 5321130	292550	12 5322480	298220	26 6 1992	Reichel and Genter 1993	
Slide Creek					1991	Gangemi 1991	survey segment unknown
Upper Twin Creek							
	12 5316400	311320	12 5317520	308720	23 6 1992	Reichel and Genter 1993	
	12 5319420	315080	12 5317520	308720	27 5 1994	Reichel and Genter 1995	
Wheeler Creek							
	12 5328870	295200	12 5330500	296800	7 8 1991	Castrén 1991	
	12 5328870	295200	12 5330500	296800	9 8 1992	Reichel and Genter 1993	
White River					1991	Gangemi 1991	survey segment unknown
	12 5270980	332450	12 5272860	327220	31 7 1991	Castrén 1991	
	12 5276350	334270	12 5272860	327220	19 7 1992	Reichel and Genter 1993	19-21 July 1992
	12 5280330	334000	12 5272860	327220	22 7 1994	Reichel and Genter 1995	22-23 July 1994
White River, South Fork							

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM			Lower UTM			#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo			
	12	5271420	336520	12	5372130	334710	20	7	1992
<b>Wounded Buck Creek</b>									
12	5347400	280600	12	5351320	282250	30	8	1989	4 Miller 1989
12	5347400	280600	12	5351320	282250	22	5	1990	Carlson 1990
12	5347400	280600	12	5351320	282250	6	6	1990	Carlson 1990
12	5347400	280600	12	5351320	282250	31	7	1990	1 Carlson 1990
12	5348600	280500	12	5350210	281430	5	6	1992	Reichel and Genter 1993
12	5347400	280600	12	5351320	282250	7	8	1992	Reichel and Genter 1993
<b>Wildcat Creek</b>									
Youngs Creek							1991		Gangemi 1991 survey segment unknown
12	5242930	326830	12	5256750	335440	21	7	1991	Castrén 1991
12	5241320	326800	12	5256750	335440	15	7	1992	Reichel and Genter 1993 15-17 July 1992
<b>Stillwater River Drainage: 17010210</b>									
<b>Good Creek</b>									
11	5372180	667330	11	5374400	675000	31	8	1989	Kerr 1989
11	5372730	671140	11	5374670	674450	21	5	1990	Carlson 1990
11	5372730	671140	11	5374670	674450	23	7	1990	Carlson 1990
<b>Fitzsimmons Creek</b>									
Logan Creek							5	1989	Fairman, Genter, and Miller 198 survey segment unknown
11	5363100	673650	11	5364890	679100	14	5	1989	Kerr 1989
11	5365690	673680	11	5364890	679100	21	5	1990	Carlson 1990
11	5363100	673650	11	5364890	679100	21	6	1990	Carlson 1990
11	5363100	673650	11	5364890	679100	24	7	1990	Carlson 1990
<b>Stillwater River</b>									
11	5400400	666570	11	5395310	666560	4	6	1990	Fairman, Genter, and Miller 198 survey segment unknown
11	5400400	666570	11	5395310	666560	27	7	1990	Carlson 1990
11	5397360	666910	11	5393360	664850	25	5	1994	Gangemi 1991 survey segment unknown
11	5400400	666570	11	5397360	666910	6	6	1994	Reichel and Genter 1995
Swift Creek									Reichel and Genter 1995
11	5391000	680670	11	5386780	683160	15	6	1990	Fairman, Genter, and Miller 198 survey segment unknown
11	5391940	680440	11	5386780	683160	28	7	1990	Carlson 1990
						23	7	1991	1 Gangemi 1991 survey segment unknown

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen			
11 5391940	680440	11	5386780	683160	11	5	1994		1	Reichel and Genter 1995	
11 5386780	683160	11	5373150	689720	23	5	1994		4	Reichel and Genter 1995	
11 5384680	684640	11	5373150	689720	10	8	1994			Reichel and Genter 1995	

**Swan River Drainage: 17010212**

Glacier Creek	12 5259440	293570	12	5256280	292700	5	8	1992		Reichel and Genter 1993	
Lost Creek	12 5307080	290830	12	5305580	287000	7	6	1993		Reichel and Genter 1994	
Swan River (tributaries covered separately)	12 5246030	290960	12	5259840	297690	4	8	1992		Reichel and Genter 1993	4-5 August 1992

**Lower Clark Fork River Drainage: 17010213**

Beaver Creek	11 5286080	613090	11	5295050	609700	21	5	1988		Miller 1988	
	11 5293130	609930	11	5295050	609700	24	7	1988		Miller 1988	
Big Beaver Creek	11 5281140	601060	11	5285640	613770	1	6	1993	both	Reichel and Genter 1994	
	11 5303840	649780	11	5303550	649260	9	6	1989		Miller 1989	
Big Rock Creek	11 5303120	651890	11	5303550	649260	17	7	1989		Miller 1989	
Blue Creek											
Blue Creek, East Fork	11 5328200	573710	11	5327410	572530	7	8	1988		Miller 1988	
	11 5328200	573710	11	5327410	572530	7	6	1989		Fairman, Genter, and Miller 1989	
Blue Creek, West Fork	11 5331830	570350	11	5330480	571290	7	8	1988		Miller 1988	
Bull River (tributaries covered separately)	11 5338610	588070	11	5337600	584980	12	7	1988		Miller 1988	
	11 5333200	584400	11	5319950	586150	2	8	1988		Miller 1988	
	11 5324690	589180	11	5320500	586070	14	5	1989		Miller 1989	
	11 5335080	584040	11	5329200	586550	24	6	1989		Miller 1989	
	11 5321370	586530	11	5320500	586070	7	8	1989		Miller 1989	
	11 5324690	589180	11	5320500	586070	1	8	1990		Fairman and Miller 1989	
Bull River, East Fork	11 5330780	597610	11	5330130	592580	12	7	1988		Miller 1988	
	11 5330780	597610	11	5330130	592580	2	8	1988		Miller 1988	
						7	6	1989		Fairman, Genter, and Miller 198 survey segment unknown	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydrologic Code

Stream	Upper UTM			Lower UTM			#	Source	Comments
	zon N/S utm	E/W utm	zon	N/S utm	E/W utm	Da			
	11	5328850	590710	11	5330130	592580	6	5	1994
Bull River, North Fork	11	5340550	589750	11	5339030	588550	11	7	1988
Bull River, South Fork	11	5334990	590380	11	5339030	588550	12	7	1988
Dry Creek	11	5333830	582720	11	5332880	584230	20	6	1990
Elk Creek	11	5320010	578580	11	5322910	579620	26	7	1988
	11	5320010	578580	11	5322910	579620	26	6	1989
	11	5320010	578580	11	5322910	579620	7	8	1989
Elk Creek, East Fork	11	5313850	575670	11	5317640	575140	3	7	1988
						14	5	1989	Miller 1989
						26	6	1989	Miller 1989
						7	8	1989	Miller 1989
	11	5313850	575670	11	5317640	575140	13	6	1990
	11	5313070	576030	11	5317640	575140	17	7	1990
	11	5311130	577660	11	5308250	579250	2	7	1991
	11	5312060	576650	11	5308250	579250	4	8	1991
	11	5312060	576650	11	5308250	579250	22	8	1991
	11	5309950	578530	11	5313850	575670	13	5	1993
Elk Creek, West Fork	11	5316950	572660	11	5317530	574980	2	7	1991
	11	5316950	572660	11	5317530	574980	4	8	1991
	11	5316950	572660	11	5317530	574980	22	8	1991
Fishtrap Creek	11	5290400	645340	11	5286020	645720	9	8	1988
	11	5297290	638840	11	5286020	645720	29	5	1989
	11	5303580	637070	11	5286020	645720	12	7	1989
	11	5297290	638840	11	5286020	645720	28	8	1989
	11	5293180	640220	11	5286020	645720	28	6	1990
	11	5297290	638840	11	5286020	645720	6	8	1990
Fishtrap Creek, West Fork	11	5296200	637580	11	5297320	638980	29	5	1989
	11	5296200	637580	11	5297320	638980	12	7	1989
Graves Creek	11	5286350	621690	11	5281950	619540	20	5	1989
									Miller 1989

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM			Lower UTM			#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen	
11 5286760	622250	11	5281950	619540	6	7	1989	Miller 1989	
11 5286350	621690	11	5281950	619540	16	8	1989	Miller 1989	
11 5286350	621690	11	5281950	619540	26	6	1990	Fairman and Miller 1990	
11 5286760	622250	11	5281950	619540	26	7	1990	Fairman and Miller 1990	
11 5289480	626780	11	5281950	619540	8	7	1991	Merz 1991	
11 5286350	621690	11	5281950	619540	18	8	1991	Merz 1991	
11 5286350	621690	11	5281950	619540	6	8	1992	Reichel and Genter 1993	
11 5281950	619540	11	5286350	621690	14	5	1993	Reichel and Genter 1994	
<b>Little Thompson River</b>									
11 5287580	648740	11	5287870	647870	9	6	1989	Miller 1989	
11 5282570	653780	11	5287870	647870	19	7	1989	Miller 1989	
11 5282100	650340	11	5287870	647870	28	8	1989	Miller 1989	
<b>Marten Creek</b>									
11 5303900	583880	11	5303580	593570	19	6	1987	9 E. Crowe & E. Ash, pers. comm.	
11 5303900	583880	11	5303580	593570	18	6	1988	7 Miller 1988	
11 5303900	583880	11	5303580	593570	3	7	1988	Miller 1988	
11 5304780	589150	11	5303580	593570	25	7	1988	Miller 1988	
11 5304050	591450	11	5303580	593570	14	5	1989	Miller 1989	
11 5304050	591450	11	5303580	593570	6	6	1989	Fairman, Genter, and Miller 1989	
11 5304820	588310	11	5303580	593570	29	6	1989	1 Miller 1989	
11 5304780	589150	11	5303580	593570	11	8	1989	14 Miller 1989	
11 5304050	591450	11	5303580	593570	5	5	1990	1 Fairman and Miller 1990	
11 5304050	591450	11	5303580	593570	19	5	1990	3 Fairman and Miller 1990	
11 5304820	588310	11	5303580	593570	12	6	1990	Fairman and Miller 1990	12-13 June 1990
11 5303900	583880	11	5303580	593570	16	7	1990	Fairman and Miller 1990	16-17 July 1990
11 5304820	588310	11	5303580	593570	10	8	1990	4 Fairman and Miller 1990	
11 5303900	583880	11	5303580	593570	29	6	1991	3 Merz 1991	
11 5303900	583880	11	5303580	593570	3	8	1991	Merz 1991	
11 5303900	583880	11	5303580	593570	20	8	1991	Merz 1991	
11 5304820	588310	11	5303580	593570	1	6	1992	Reichel and Genter 1993	
11 5304550	586760	11	5303580	593570	4	8	1992	18 Reichel and Genter 1993	
11 5304140	584350	11	5303580	593570	13	5	1993	9 Reichel and Genter 1994	
11 5303900	583880	11	5303580	593570	26	5	1993	1 Reichel and Genter 1994	
11 5304140	584350	11	5303580	593570	2	6	1993	3 Reichel and Genter 1994	
11 5304300	585590	11	5303580	593570	29	7	1993	10 Reichel and Genter 1994	
11 5304550	586760	11	5303580	593570	4	5	1994	13 Reichel and Genter 1995	
11 5304820	588310	11	5303580	593570	29	7	1994	Reichel and Genter 1995	
<b>Marten Creek, North Branch</b>									

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydlogic Code

Stream	Upper UTM zon N/S utm	E/W utm zon N/S utm	Lower UTM zon N/S utm	E/W utm zon N/S utm	Da	Mo	Year	Type seen	#	Source	Comments
Marten Creek, South Fork	11 5299390	589410	11 5303120	592740	19	6	1987		16	E. Crowe & E. Ash, pers. comm.	
	11 5301550	591520	11 5303120	592740	13	6	1988		7	Miller 1988	
	11 5300920	590950	11 5303120	592740	25	7	1988			Miller 1988	
	11 5302010	592000	11 5303120	592740	14	5	1989		2	Miller 1989	
	11 5300920	590950	11 5303120	592740	29	6	1989		1	Miller 1989	
	11 5300900	590310	11 5303120	592740	11	8	1989			Miller 1989	
	11 5302010	592000	11 5303120	592740	5	5	1990			Fairman and Miller 1990	
	11 5299580	589690	11 5303120	592740	9	5	1990		2	Fairman and Miller 1990	
	11 5302010	592000	11 5303120	592740	19	5	1990			Fairman and Miller 1990	
	11 5301550	591520	11 5303120	592740	12	6	1990			Fairman and Miller 1990	
	11 5300920	590950	11 5303120	592740	16	7	1990			Fairman and Miller 1990	
	11 5298960	588470	11 5303120	592740	28	6	1991		3	Merz 1991	
	11 5300900	590310	11 5303120	592740	3	8	1991		5	Merz 1991	
	11 5300900	590310	11 5303120	592740	12	5	1992		6	Reichel and Genter 1993	
	11 5302010	592000	11 5303120	592740	1	6	1992			Reichel and Genter 1993	
	11 5301550	591520	11 5303120	592740	4	8	1992			Reichel and Genter 1993	
	11 5300900	590310	11 5303120	592740	13	5	1993		3	Reichel and Genter 1994	
	11 5300900	590310	11 5303120	592740	26	5	1993		4	Reichel and Genter 1994	
	11 5300920	590950	11 5303120	592740	2	6	1993		2	Reichel and Genter 1994	
	11 5300900	590310	11 5303120	592740	29	7	1993			Reichel and Genter 1994	
	11 5300900	590310	11 5303120	592740	4	5	1994		1	Reichel and Genter 1995	
	11 5300920	590950	11 5303120	592740	29	7	1994			Reichel and Genter 1995	
Marten Creek, South Branch	11 5302800	582670	11 5303900	583880	1	7	1991		2	Merz 1991	
	11 5303430	583300	11 5303900	583880	3	8	1991		1	Merz 1991	
McNeely Creek	11 5300700	589000	11 5300700	590780	28	6	1991			Fairman and Miller 1990	
Napoleon Gulch	11 5328710	584990	11 5329250	585760	20	6	1990				
Pilgrim Creek	11 5313720	589740	11 5316070	592020	26	7	1988				
Prospect Creek	11 5268640	616420	11 5271890	623470	3	7	1989				
	11 5268940	618860	11 5271890	623470	16	8	1989				
											survey segment unknown

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

Drainage: Hydologic Code

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen			
Rock Creek	11 5269540	620370	11 5271890	623470	14	8	1990			Fairman and Miller 1990	
	11 5319600	596510	11 5315120	596380	13	6	1988			Miller 1988	12-13 June 1988; survey
	11 5319600	596510	11 5315900	596920	14	5	1989			Miller 1988	13-14 July 1988
											survey segment unknown
	11 5319600	596510	11 5315900	596920	27	6	1989		2	Miller 1989	
	11 5319600	596510	11 5315900	596920	8	8	1989			Miller 1989	
	11 5321100	598210	11 5315900	596920	24	5	1990			Fairman and Miller 1990	
	11 5319600	596510	11 5315120	596380	14	6	1990			Fairman and Miller 1990	
	11 5320500	597450	11 5319600	596510	20	7	1990			Fairman and Miller 1990	
	11 5320850	597950	11 5315120	596380	19	8	1990			Fairman and Miller 1990	19-20 Aug 1990
	11 5321100	598210	11 5314070	593970	26	6	1991		1	Merz 1991	26-27 June 1991
	11 5319600	596510	11 5314070	593970	17	8	1991			Merz 1991	
	11 5320500	597450	11 5314070	593970	4	8	1992			Reichel and Genter 1993	1-5 Aug 1992
	11 5320500	597450	11 5315120	596380	31	7	1993			Reichel and Genter 1994	
	11 5319600	596510	11 5315120	596380	5	5	1994			Reichel and Genter 1995	
	11 5320850	597950	11 5314070	593970	28	7	1994			Reichel and Genter 1995	
Swamp Creek											
	11 5310850	605010	11 5307210	603130	12	6	1988			Miller 1988	
	11 5312290	605330	11 5307210	603130	1	8	1988		1	Miller 1988	
	11 5307950	603900	11 5307210	603130	20	5	1989			Miller 1989	
	11 5310850	605010	11 5307210	603130	28	6	1989		12	Miller 1989	
	11 5310850	605010	11 5307210	603130	10	8	1989			Miller 1989	
	11 5307950	603900	11 5307210	603130	5	5	1990			Fairman and Miller 1990	
	11 5307950	603900	11 5307210	603130	19	5	1990			Fairman and Miller 1990	
	11 5310850	605010	11 5307210	603130	25	6	1990			Fairman and Miller 1990	
	11 5313290	606010	11 5307210	603130	9	8	1990			Fairman and Miller 1990	
	11 5313290	606010	11 5307950	603900	25	6	1991		8	Merz 1991	
	11 5314140	606900	11 5308000	597900	11	8	1991			Merz 1991	
	11 5312290	605330	11 5308000	597900	13	5	1992			Reichel and Genter 1993	
	11 5310850	605010	11 5307210	603130	6	8	1992			Reichel and Genter 1993	
	11 5313290	606010	11 5308000	597900	11	5	1993		2	Reichel and Genter 1994	
	11 5314140	606900	11 5307210	603130	30	7	1993		3	Reichel and Genter 1994	30 Jul-2 Aug 1993
	11 5312290	605330	11 5308000	597900	6	5	1994		1	Reichel and Genter 1995	
Thompson River (tributaries covered separately)											
	11 5286020	645720	11 5270560	632440	8	8	1988			Miller 1988	8-9 May 1988
	11 5286020	645720	11 5270560	632440	29	5	1989			Miller 1989	
	11 5294020	649240	11 5270560	632440	9	6	1989			Miller 1989	

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydologic Code**

Stream	Upper UTM zon N/S utm	E/W utm	zon N/S utm	E/W utm	Da	Mo	Year	Type seen	Source	Comments
Thompson River, West Fork	11 5287870	647870	11 5270560	632440	10	7	1989		Miller 1989	10-11 July 1989
	11 5282360	643570	11 5287870	647870	17	7	1989		Miller 1989	17-18 July 1989
	11 5287870	647870	11 5270560	632440	21	8	1989		Miller 1989	21-22 August 1989
	11 5305430	647240	11 5298790	648030	2	8	1990		Fairman and Miller 1990	
Trout Creek	11 5295870	597730	11 5298310	601600	28	5	1988		Miller 1988	
	11 5298310	601600	11 5299250	603180	24	7	1988		Miller 1988	
Trout Creek, East Fork	11 5293460	595740	11 5295230	596060	28	5	1988		Miller 1988	
Vermilion River	11 5303080	626200	11 5297700	609180	4	6	1988		Miller 1988	4-5 June 1988
	11 5300550	627200	11 5297700	609180	15	7	1988		Miller 1988	13-19 July 1988
	11 5300920	612000	11 5297700	609180	20	5	1989		Miller 1989	
	11 5301190	613820	11 5297700	609180	7	7	1989		Miller 1989	
	11 5303890	628010	11 5297700	609180	14	8	1989		Miller 1989	
	11 5300920	612000	11 5300100	610520	5	5	1990		Fairman and Miller 1990	
	11 5301050	613250	11 5300100	610520	19	5	1990		Fairman and Miller 1990	
	11 5301190	613820	11 5300100	610520	12	7	1990		Fairman and Miller 1990	
	11 5303890	628010	11 5300100	610520	16	8	1990		Fairman and Miller 1990	
	11 5293170	627350	11 5297700	609180	23	6	1991		Merz 1991	15-17 Aug 1990
	11 5303890	628010	11 5297700	609180	10	8	1991		Merz 1991	20-24 June 1991
	11 5303500	625300	11 5303890	628010	21	8	1991		Merz 1991	
	11 5302800	620650	11 5297700	609180	1	6	1992		Reichel and Genter 1993	1-2 June 1992
	11 5303890	628010	11 5297700	609180	6	8	1992		Reichel and Genter 1993	5-6 Aug 1992
	11 5296100	627350	11 5297700	609180	12	5	1993		Reichel and Genter 1994	
	11 5302800	620650	11 5297700	609180	27	5	1993		Reichel and Genter 1994	
	11 5297900	627370	11 5297700	609180	27	7	1993		Reichel and Genter 1994	
	11 5300550	627200	11 5297700	609180	3	5	1994		Reichel and Genter 1995	
	11 5302800	620650	11 5297700	609180	29	7	1994		Reichel and Genter 1995	
Cataract Creek	11 5301040	615110	11 5301370	614700	17	7	1988		Miller 1988	
Happy's Gulch Creek										

**Appendix H. Harlequin Duck Surveys in Montana 1987-94.**

**Drainage: Hydrologic Code**

Stream	Upper UTM				Lower UTM				#	Source	Comments
	zon	N/S utm	E/W utm	zon	N/S utm	E/W utm	Da	Mo			
Miller Creek	11	5296570	626770	11	5296500	627300	19	7	1988	Miller 1988	
Willow Creek	11	5298200	626340	11	5298070	627370	19	7	1988	Miller 1988	
White Pine Creek	11	5305010	628330	11	5303070	626170	20	6	1991	Merz 1991	20-24 June 1991
	11	5286040	597550	11	5289530	610640	21	5	1988	Miller 1988	
	11	5289850	607160	11	5289710	611150	24	7	1988	Miller 1988	